CLACKAMAS
WATER ENVIRONMENT SERVICES

GREGORY L. GEIST | DIRECTOR
Water Quality Protection
Surface Water Management
Wastewater Collection & Treatment

December 4, 2025 BCC Agenda Date/Item: _____

Board of County Commissioners
Acting as the governing body of Water Environment Services
Clackamas County

Approval of a Contract with Dewitt Construction for South Welches, Golf Club Terrace, 82nd Ave and Sieben Lane Pump Station rehabilitation and upgrades. Contract Value is $3,408,253 for 2 years. Funding is through WES Sanitary Sewer Construction Funds.
No County General Funds are involved.

Previous Board Action/Review	N/A		
Performance Clackamas	1. This project supports the WES Strategic Plan to strategically plan and execute capital projects to meet the growth, reliability, and regulatory needs of our service area at the lowest-life cycle cost. 2. This project supports the County's Strategic Priorities of Strong Infrastructure, Vibrant Economy, and Safe, Secure and Livable Communities.		
Counsel Review	Yes	**Procurement Review**	Yes
Contact Person	Jessica Rinner	**Contact Phone**	503-742-4551

EXECUTIVE SUMMARY: WES is currently implementing the Pump Station Rehabilitation and Upgrades Project. Improvements to the pump stations will increase reliability, safety and operational efficiency. This contract is for the construction of the Group 3, which includes: South Welches, Golf Club Terrace, 82nd Avenue and Sieben Lane pump stations. The scope of work included in this construction contract are: replacement of electrical, control, process mechanical, and HVAC; demolition and upgrades in the Wet Well; installing permanent bypassing ports, construction of force main realignment, site work and surface restoration, and other miscellaneous work necessary to complete the project. Construction of these improvements will be completed by March 1, 2028. The Pump Station Rehabilitation and Upgrades Project is in the adopted 5-year CIP and funds are programmed in the sanitary sewer construction fund.

RECOMMENDATION: Staff recommend that the Board of County Commissioners of Clackamas County, acting as the governing body of Water Environment Services, approve Contract #1489 with Dewitt Construction, Inc. for Pump Station Rehabilitation and Upgrades Project

For Filing Use Only

Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sieben Lane Pump Stations.

Respectfully submitted,

Ron Wierenga
Deputy Director, WES

Attachment: Contract #1489 with Dewitt Construction, Inc.

WATER ENVIRONMENT SERVICES
AGREEMENT BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT #0000001489

This Agreement is entered into by and between Water Environment Services ("Owner"), an intergovernmental entity formed pursuant to Oregon Revised Statutes Chapter 190, and **Dewitt Construction, Inc.** ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions, both identified more specifically in Article 7 below. All references to General Conditions implicitly include a reference to any modifications made by the Supplementary Conditions to the same paragraph.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

A. Schedule A: South Welches Pump Station

Establishment of erosion and sediment control, tree protection, temporary golf ball netting and temporary construction fencing, demolition of existing building roof, wet well top slab, pumps, discharge piping, level sensors, valve vault, a section of existing force main, existing trees and a section of asphalt pavement, establishment of temporary bypass, installation of new building roof, HVAC, electrical and controls equipment, wet well top slab and upgrades, pumps, discharge piping, level sensors, precast bypass vault with permanent bypass port, precast valve vault, drain pipe between valve vault and wet well, yard hydrant, connection to existing force main, disconnect panel and cable trench between building and wet well, generator with concrete base, asphalt pavement, aggregate site surfacing, and bollards.

B. Schedule B: Golf Club Terrace Pump Station

Establishment of erosion and sediment control, demolition of existing wet well top slab, valve vault, cable box adjacent to wet well, control building, fencing and gate, overhead power service, trees, establishment of temporary bypass, installation of new building with water service, HVAC, electrical and controls equipment, aggregate site surfacing, wet well top slab with hatch, pumps, discharge piping, level sensors, precast valve vault with air release valve, precast bypass vault with permanent bypass port, disconnect panel and cable trench adjacent to wet well, generator with concrete base, fence gates, bollards, replacement fencing and utility gate and connection to existing force main.

C. Schedule C: 82nd Ave Pump Station

Establishment erosion and sediment control, demolition of the existing wet well fiberglass enclosure, pumps, discharge piping and connection to existing force main, above ground control and power panels, trees, relocation of existing antenna pole, establishment of temporary bypass, installation of new wet well top risers and slab with hatch, pumps, discharge piping, precast valve vault, precast bypass vault with permanent bypass, drain pipe between valve vault and wet well, disconnect panel and cable trench adjacent to wet well, power and control panels,

aggregate site surfacing, brush clearing, generator with concrete base, establishing a fenced perimeter around the site with a large utility gate and man gate, and connection to existing force main.

D. Schedule D: Sieben Lane Pump Station

Establishment of erosion and sediment control, establishment of temporary bypass, demolition of existing pumps, discharge piping, HVAC, wet well and valve vault top slabs, disconnect panel and cable trench adjacent to wet well, asphalt pavement, installation of new electrical equipment, generator with concrete base, submersible level controls, pumps, discharge piping, wet well and valve vault top slabs with hatches, water service with RPBA and meter relocation, asphalt pavement and replacement of antenna pole mounted light.

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

Pump Station Rehabilitation and Upgrades at the South Welches, Golf Club Terrace, 82nd Ave and Sieben Lane Pump Stations

ARTICLE 3—ENGINEER

3.01 The Owner has retained Consor North America ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by Engineer.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and final completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.03 *Contract Times: Days*

A. The Work will be substantially complete within 500 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 560 days after the date when the Contract Times commence to run.

4.04 *Milestones*

A. Parts of the Work must be substantially completed on or before the following Milestone(s):

1. Milestone 1**:** 90 days for Equipment and Materials Submittals Approval from Notice to Proceed. This should include all equipment and materials that will take more than 6 weeks to be delivered.

2. Milestone 2: 100 days for substantial completion of South Welches Pump Station once on-site work begins. Work cannot begin until September 15th after the Golf Course closes without approval of the Owner. Work must be completed no later than March 1st, 2028.
3. Milestone 3: 100 days for substantial completion of Golf Club Terrace Pump Station once on-site work begins. Work must be completed no later than March 1st, 2028
4. Milestone 4: 90 days for substantial completion of 82nd Ave Pump Station once on-site work begins.
5. Milestone 5: 100 days for substantial completion of Sieben Lane Pump Station once on-site work begins. Work must be completed no later than March 1st, 2027.

Note: Milestones 2 through 5 do not need to be completed in sequential order.

4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner **$930 for each day** that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.
2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner **$930 for each day** that expires after such time until the Work is completed and ready for final payment.
3. *Milestones:* Contractor shall pay Owner **$930 for each day** that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of each Milestone, until each Milestone is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate.
4. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

ARTICLE 5 - CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment): **Three Million Four Hundred Eight Thousand Two Hundred Fifty-Three Dollars ($3,408,253.00);**

B. For all Work, at the prices stated in Contractor's Bid, attached hereto as Exhibit A.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about 30 days following receipt of an Application for Payment during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. Ninety-five (95) percent of the value of the Work completed (with the balance being retainage). Retainage will be held in an interest-bearing escrow account. Interest on the retainage amount accrues from the date the payment request is approved until the date the retainage is paid to the Contractor.

B. Upon final completion, Owner shall pay an amount sufficient to increase total payments to Contractor to one-hundred (100) percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions.

C. Alternatives to Retainage

1. In lieu of retainage, Contractor, with the approval of Owner, may deposit a surety bond for all or any portion of the retainage in a form acceptable to Owner. Such bond and any proceeds therefrom shall be made subject to all claims and liens as provided for in ORS 279C.550 to 279C.620.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

ARTICLE 7 – CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds, attached hereto and incorporated herein as Exhibit B:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions, attached hereto and incorporated herein as Exhibit C. The General Conditions that are made a part of this Contract are EJCDC® C 700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee ("General Conditions"), and Owner has plainly shown all modifications to the standard wording of such published document to the Contractor in the Supplementary Conditions.
4. Supplementary Conditions, attached hereto and incorporated herein as Exhibit D.
5. Specifications, attached hereto and incorporated as Exhibit E.
6. Drawings, attached hereto and incorporated as Exhibit F.
8. Addenda (numbers **1** to **2** inclusive).
9. Prevailing Wage Rates (not attached but incorporated by reference).
10. Payroll and Certified Statement Form (not attached but incorporated by reference).
12. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.
    e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement and incorporated herein (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 5—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.

2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions, if any, at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.
12. Contractor represents and warrants to Owner that (A) Contractor has the power and authority to enter into and perform this Contract; (B) this Contract, when executed and delivered, shall be a valid and binding obligation of Contractor enforceable in accordance with its terms; (C) Contractor shall at all times during the term of this Contract, be qualified, professionally competent, and duly licensed to perform the Work; (D)

Contractor is an independent contractor as defined in ORS 670.600; and (E) the Work under this Contract shall be performed in a good and workmanlike manner and in accordance with the highest professional standards. The warranties set forth in this section are in addition to, and not in lieu of, any other warranties provided.

13. Contractor represents and warrants that it has complied, and will continue to comply throughout the duration of this Contract and any extensions, with all tax laws of this state or any political subdivision of this state, including but not limited to ORS 305.620 and ORS chapters 316, 317, and 318. Any violation of this section shall constitute a material breach of this Contract and shall entitle Owner to terminate this Contract, to pursue and recover any and all damages that arise from the breach and the termination of this Contract, and to pursue any or all of the remedies available under this Contract or applicable law.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

B. Contractor shall furnish proof of required insurance in accordance with Paragraph 6.02 of the General Conditions and Supplemental General Conditions. Insurance certificates may be returned with the signed Agreement or may be emailed to Procurement@clackamas.us.

8.03 *Miscellaneous Terms*

A. Change Order Authorization. Throughout the performance of the Work under this Agreement, the Owner's Designated Representative (identified on the signature page) is hereby granted the authority to verbally authorize change orders in the field for an amount up to $10,000. As soon as possible following the authorization, the Owner's Designated Representative shall complete the change order form provided by Clackamas County Procurement ("Procurement"), obtain the signature of Owner's Director or other authorized signatory, and submit the form to Procurement for processing. As soon as the Director signs off on the change order form, the Designated Representative may then authorize another change order in the future for up to $10,000 following the same procedure above. Each change order should include the cumulative cost of the entire change and may not be artificially broken up into multiple change orders to fall under the dollar threshold listed above. The authority granted

to the Designated Representative is limited by the Director's authorization to amend the Agreement under Clackamas County's Local Contract Review Board Rules and is subject to the discretion of the Director, who may suspend or restrict the Designated Representative's ability to authorize change orders at any time for any reason.

B. Counterparts. This Contract may be executed in several counterparts, all of which when taken together shall constitute an agreement binding on all Parties, notwithstanding that all Parties are not signatories to the same counterpart. Each copy of the Contract so executed shall constitute an original.

C. Required Provisions. All provisions of state law required to be part of this Contract, whether listed in the General Conditions or Supplementary Conditions or otherwise, are hereby integrated and adopted herein. Contractor acknowledges the obligations thereunder and that failure to comply with such terms is a material breach of this Contract.

D. Integration. The Contract Documents constitute the entire agreement between the parties. There are no other understandings, agreements or representations, oral or written, not specified herein regarding this Contract. Contractor, by the signature below of its authorized representative, hereby acknowledges that it has read this Contract, understands it, and agrees to be bound by its terms and conditions.

Signature Page Follows

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on the last date of signature by the parties below (which is the Effective Date of the Contract).

Owner:

Water Environment Services

By: _____
(individual's signature)

Date: _____
(date signed)

Name: Craig Roberts
(typed or printed)

Title: Chair
(typed or printed)

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Address for giving notices:

ATTN: Jessica Rinner

150 Beavercreek Road #430

Oregon City, OR 97045

Designated Representative:

Name: Jessica D. Rinner
(typed or printed)

Title: Civil Engineer Supervisor
(typed or printed)

Address:

150 Beavercreek Road #430

Oregon City, OR 97045

Phone: 503-742-4551

Email: JRinner@clackamas.us

Approved for Legal Sufficiency:

11/6/2025

County Counsel

Contractor:

Dewitt Construction, Inc.
(typed or printed name of organization)

By: _____
(individual's signature)

Date: 10/24/2025
(date signed)

Name: Ty DeWitt
(typed or printed)

Title: President
(typed or printed)

Attest: _____
(individual's signature)

Title: Risk and Safety Manager
(typed or printed)

Address for giving notices:

Attn: Ty DeWitt

PMB201, 13023 NE Highway 99, Suite 7

Vancouver, WA 98686

Designated Representative:

Name: Rob Richardson
(typed or printed)

Title: Project Manager
(typed or printed)

Address:

10311 NE 72nd Ave.

Vancouver, WA 98686

Phone: 360-600-3446

Email: rricharson@dewittconst.com

License No.: 63072
(where applicable)

State: Oregon

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT OPPORTUNITY

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CLACKAMAS COUNTY
NOTICE OF PUBLIC IMPROVEMENT CONTRACT OPPORTUNITY

INVITATION TO BID #2025-63
Pump Station Rehabilitation and Upgrades Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sieben Lane Pump Stations
July 23, 2025

Clackamas County ("County") on behalf of Water Environment Services through their Board of County Commissioners is accepting sealed bids for the **Pump Station Rehabilitation and Upgrades Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sieben Lane Pump Stations** Project until **August 21, 2025, 2:00 PM,** Pacific Time, ("Bid Closing") at the following location:

Bidding Documents can be downloaded from the state of Oregon procurement website ("OregonBuys") at the following address: https://oregonbuys.gov/bso/view/login/login.xhtml, Document No.S-C01010-00014430.
Prospective Bidders will need to sign in to download the information and that information will be accumulated for a Plan Holder's List. Prospective Bidders are responsible for obtaining any Addenda from Website listed above.

Submitting Proposals: Bid Locker
Proposals will only be accepted electronically thru a secure online bid submission service, **Bid Locker**.
Email submissions to Clackamas County email addresses will no longer be accepted.

A. Completed proposal documents must arrive electronically via Bid Locker located at https://bidlocker.us/a/clackamascounty/BidLocker.
B. Bid Locker will electronically document the date and time of all submissions. Completed documents must arrive by the deadline indicated in Section 1 or as modified by Addendum. LATE PROPOSALS WILL NOT BE ACCEPTED.
C. Proposers must register and create a profile for their business with Bid Locker in order to submit for this project. It is free to register for Bid Locker.
D. Proposers with further questions concerning Bid Locker may review the Vendor's Guide located at https://www.clackamas.us/how-to-bid-on-county-projects .

Engineers Estimate: $4,110,000.00

Contact Information
Procurement Process and Technical Questions: Tralee Whitley at Twhitley@clackamas.us .

A **Mandatory Pre-Bid Conference** will be conducted on **August 7**, **2025 at 1:00 PM**. Bidders shall meet with County representatives at **Developmental Services Building, 150 Beavercreek Road, Suite 430, Oregon City** for that purpose. Attendance will be documented through a sign-in sheet prepared by the County representative. Prime bidders who arrive more than ten (10) minutes after the start time of the meeting (as stated in the solicitation and by the County's watch) or after the discussion portion of the meeting (whichever comes first) shall not be permitted to sign in and will not be permitted to submit a bid on the project.

Bids will be opened and publicly read aloud at the above Delivery address after the Bid Closing. Bid results will also be posted to the OregonBuys listing shortly after the opening.

Prevailing Wage
Prevailing Wage Rates requirements apply to this Project because the maximum compensation for all Owner-contracted Work is more than $50,000. Contractor and all subcontractors shall comply with the provisions of ORS 279C.800 through 279C.870, relative to Prevailing Wage Rates. The Bureau of Labor and Industries (BOLI) wage rates and requirements set forth in the following BOLI booklet (and any listed amendments to that booklet), which are incorporated herein by reference, apply to the Work authorized under this Agreement:

PREVAILING WAGE RATES for Public Works Contracts in Oregon, July 5 ,2025, which can be downloaded at the following web address:, which can be downloaded at the following web address:
http://www.oregon.gov/boli/WHD/PWR/Pages/pwr_state.aspx
The Work will take place in Clackamas County, Oregon.

Clackamas County encourages bids from Minority, Women, and Emerging Small Businesses.

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

INSTRUCTIONS TO BIDDERS

Clackamas County Local Contract Review Board Rules ("LCRB Rules") govern this procurement process. LCRB Rules may be found at: http://www.clackamas.us/code/documents/appendixc.pdf. The Instructions to Bidders is applicable to the procurement process for Clackamas County, or any component unit thereof identified on the Notice of Public Improvement Contract Opportunity, herein after referred to as the "Owner."

Article 1. Scope of Work

The work contemplated under this contract with the Owner, includes all labor, materials, transportation, equipment and services necessary for, and reasonably incidental to, the completion of all construction work in connection with the project described in the Project Manual which includes, but is not necessarily limited to, the Notice of Public Improvement Contract Opportunity, Instructions to Bidders, Supplemental Instructions to Bidders, Bid Form, Bid Bond, Public Improvement Contract Form, Performance Bond, Payment Bond, Clackamas County General Conditions for Public Improvement Contracts (10/13/2021), Supplemental General Conditions, and Plans, Specifications and Drawings.

Article 2. Examination of Site and Conditions

Before making a Bid, the Bidder shall examine the site of the work and ascertain all the physical conditions in relation thereto. The Bidder shall also make a careful examination of the Project Manual including the plans, specifications, and drawings and other contract documents, and shall be fully informed as to the quality and quantity of materials and the sources of supply of the materials. Failure to take these steps will not release the successful Bidder from entering into the contract nor excuse the Bidder from performing the work in strict accordance with the terms of the contract at the price established by the Bid.

The Owner will not be responsible for any loss or for any unanticipated costs, which may be suffered by the successful Bidder, as a result of such Bidder's failure to be fully informed in advance with regard to all conditions pertaining to the work and the character of the work required, including site conditions. No statement made by an elected official, officer, agent, or employee of the Owner in relation to the physical or other conditions pertaining to the site of the work will be binding on the Owner, unless covered by the Project Manual or an Addendum.

Article 3. Interpretation of Project Manual and Approval of Materials Equal to Those Provided in the Specifications

If any Bidder contemplating submitting a Bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications or forms of contract documents, or detects discrepancies or omissions, such Bidder may submit to the Architect (read "Engineer" throughout in lieu of Architect as appropriate) a written request for an interpretation thereof at least ten (10) calendar days prior to the date set for the Bid Closing.

When a prospective Bidder seeks approval of a particular manufacturer's material, process or item of equal value, utility or merit other than that designated by the Architect in the Project Manual, the Bidder may submit to the Architect a written request for approval of such substitute at least ten (10) calendar days prior to the date set for the Bid Closing. The prospective Bidder submitting the request will be responsible for its prompt delivery.

Requests of approval for a substitution from that specified shall be accompanied by samples, records of performance, certified copies of tests by

impartial and recognized laboratories, and such other information as the Architect may request.

To establish a basis of quality, certain processes, types of machinery and equipment or kinds of materials may be specified in the Project Manual either by description of process or by designating a manufacturer by name and referring to a brand or product designation or by specifying a kind of material. Whenever a process is designated or a manufacturer's name, brand or item designation is given, or whenever a process or material covered by patent is designated or described, it shall be understood that the words "or approved equal" follow such name, designation or description, whether in fact they do so or not.

Any interpretation of the Project Manual or approval of manufacturer's material will be made only by an Addendum duly issued. All Addenda will be posted to the OregonBuys listing and will become a part of the Project Manual. The Owner will not be responsible for any other explanation or interpretation of the Project Manual nor for any other approval of a particular manufacturer's process or item for any Bidder.

When the Architect approves a substitution by Addendum, it is with the understanding that the Contractor guarantees the substituted article or material to be equal or better than the one specified.

Article 4. Security to Be Furnished by Each Bidder

Each Bid must be accompanied by either 1) a cashier's check or a certified check drawn on a bank authorized to do business in the State of Oregon, or 2) a Bid bond described hereinafter, executed in favor of the Owner, for an amount equal to ten percent (10%) of the total amount Bid as a guarantee that, if awarded the contract, the Bidder will execute the contract and provide a performance bond and payment bond as required. The successful Bidder's check or Bid bond will be retained until the Bidder has entered into a contract satisfactory to Owner and furnished a one hundred percent (100%) performance bond and one hundred percent (100%) payment bond. The Owner reserves the right to hold the Bid security as described in Article 10 hereof. Should the successful Bidder fail to execute and deliver the contract as provided for in Article 12 hereof, including a satisfactory performance bond and payment bond within twenty (20) calendar days after the Bid has been accepted by the Owner, then the contract award made to such Bidder may be considered canceled and the Bid security may be forfeited as liquidated damages at the option of the Owner. The date of the acceptance of the Bid and the award of the contract as contemplated by the Project Manual shall mean the date of acceptance specified in the Notice of Intent to Award.

Article 5. Execution of Bid Bond

Should the Bidder elect to utilize a Bid bond as described in Article 4 in order to satisfy the Bid security requirements, such form must be completed in the following manner:

A. Bid bonds must be executed on the County forms, which will be provided to all prospective Bidders by the Owner.

B. The Bid bond shall be executed on behalf of a bonding company licensed to do business in the State of Oregon.

C. In the case of a sole individual, the bond need only be executed as principal by the sole individual. In the case of a partnership, the bond must be executed by at least one of the partners. In the case of a corporation, the bond must be executed by stating the official name of the corporation under which is placed the signature of an officer authorized to sign on behalf of the corporation followed by such person's official capacity, such as president, etc. The corporation seal should then be affixed to the bond.

D. The name of the surety must be stated in the execution over the signature of its duly authorized attorney-in-fact and accompanied by the seal of the surety corporation.

Article 6. Execution of the Bid Form

Each Bid shall be made in accordance with: (i) the sample Bid Form accompanying these instructions; (ii) the appropriate signatures for a sole individual, partnership, corporation or limited liability corporation shall be added as noted in Article 5C above; (iii) numbers pertaining to base Bids shall be stated both in writing and in figures; and (iv) the Bidder's address shall be typed or printed.

The Bid Form relates to Bids on a specific Project Manual. Only the amounts and information asked for on the Bid Form furnished will be considered as the Bid. Each Bidder shall Bid upon the work exactly as specified and provided in the Bid Form. The Bidder shall include in the Bid a sum to cover the cost of all items contemplated by the Contract. The Bidder shall Bid upon all alternates that may be indicated on the Bid Form. When Bidding on an alternate for which there is no charge, the Bidder shall write the words "No Charge" in the space provided on the Bid Form. If one or more alternates are shown on the Bid Form, the Bidder shall indicate whether each is "add" or "deduct."

Article 7. Prohibition of Alterations to Bid

Bids that are incomplete, or contain ambiguities or have differing conditions required by the Bidder, including requested changes or exceptions to the Public Improvement Contract form or other portions of the Project Manual, may be rejected in Owner's sole and absolute discretion.

Article 8. Submission of Bid

Each Bid shall be sealed in an envelope, properly addressed to the Owner, showing on the outside of the envelope the name of the Bidder and the name of the project. Bids will be received at the time and place stated in the Notice of Public Improvement Contract Opportunity.

Article 9. Bid Closing and Opening of Bids

All Bids must be received by the Owner at the place and time set for the Bid Closing. Any Bids received after the scheduled Bid Closing time for receipt of Bids will be rejected.

At the time of opening and reading of Bids, each Bid received will be publicly opened and read aloud, irrespective of any irregularities or informalities in such Bids.

Generally, Bid results will be posted to the OregonBuys Website within a couple hours of the opening.

Article 10. Acceptance or Rejection of Bids by Owner

Unless all Bids are rejected, the Owner will award a contract based on the lowest responsive Bid from a responsible Bidder. If that Bidder does not execute the contract, it will be awarded to the next lowest responsible Bidder or Bidders in succession.

The Owner reserves the right to reject all Bids and to waive minor informalities. The procedures for contract awards shall be in compliance with the provisions of the LCRB Rules in effect at that time.

The Owner reserves the right to hold the Bid and Bid security of the three lowest Bidders for a period of thirty (30) calendar days from and after the time of Bid opening pending award of the contract. Following award of the contract the Bid security of the three lowest Bidders may be held twenty (20) calendar days pending execution of the contract. All other Bids will be rejected and Bid security will be returned.

In determining the lowest Bidder, the Owner reserves the right to take into consideration any or all authorized base Bids as well as alternates or combinations indicated in the Bid Form.

If no Bid has been accepted within thirty (30) calendar days after the opening of the Bids, each of the three lowest Bidders may withdraw the Bid submitted and request the return of the Bid security.

Article 11. Withdrawal of Bid

At any time prior to the Bid Closing, a Bidder may withdraw its Bid. This will not preclude the

submission of another Bid by such Bidder prior to the time set for the Bid Closing.

After the time set for the Bid Closing, no Bidder will be permitted to withdraw its Bid within the time frames specified in Article 10 for award and execution, except as provided for in that Article.

Article 12. Execution of Contract, Performance Bond and Payment Bond

The Owner will provide the successful Bidder with contract forms within seven (7) calendar days after the completion of the award protest period. The Bidder is required to execute the contract forms as provided, including a performance bond and a payment bond from a surety company licensed to do surety business in the State of Oregon, within seven (7) calendar days after receipt of the contract forms. The contract forms shall be delivered to the Owner in the number called for and to the location as instructed by the Owner.

Article 13. Recyclable Products

Contractors will use recyclable products to the maximum extent economically feasible in the performance of the Contract.

Article 14. Clarification or Protest of the Solicitation Document or Specifications

Any request for clarification or protest of the solicitation document or specifications must be submitted in the manner provided for in the applicable section of the LCRB Rules to the Procurement Representative referenced in the Notice of Public Improvement Contract Opportunity.

A protest of the Solicitation Document must be received within seven (7) business days of the issuance of the Bid or within three (3) business days of issuance of an addendum.

Requests for clarification may be submitted no less than five (5) business days prior to the Bid Closing Date.

Article 15. Protest of Intent to Award

Owner will name the apparent successful Bidder in a "Notice of Intent to Award" letter. Identification of the apparent successful Bidder is procedural only and creates no right in the named Bidder to the award of the contract. Competing Bidders will be notified by publication of the Notice of Intent to Award on the OregonBuys Website of the selection of the apparent successful Bidder(s) and Bidders shall be given seven (7) calendar days from the date on the "Notice of Intent to Award" letter to review the file at the Procurement Division office and file a written protest of award, pursuant to C-049-0450. Any award protest must be in writing and must be delivered by email, hand delivery, or mail to the Procurement Division Director at: Procurement Division, 2051 Kaen Road, Oregon City, OR 97045.

Article 16. Disclosure of First-Tier Subcontractors

Within two (2) working hours after the Bid Closing, all Bidders shall submit to the County a disclosure form identifying any first-tier subcontractors (those entities that would be contracting directly with the prime contractor) that will be furnishing labor and materials on the contract, if awarded, whose subcontract value would be equal to or greater than: (a) Five percent (5%) of the total contract price, but at least $15,000; or (b) $350,000, regardless of the percentage of the total contract price.

Disclosures may be submitted with the Bid or may be hand delivered to the Bid Closing address or emailed to the Contract Information Analyst listed on the Notice of Contract Opportunity.

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

Project Name 2025-63 Pump Station Rehabilitation and Upgrades Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sieben Lane Pump Stations

The following modify the Clackamas County "Instructions to Bidders" for this Project. Where a portion of the Instructions to Bidders has been modified by these Supplemental Instructions to Bidders, the unaltered portions shall remain in effect.

1. A Mandatory Pre-Bid Conference will be conducted on **August 7, 2025 at 1:00 PM.** Bidders shall meet with County representatives at **Developmental Services Building, 150 Beavercreek Road, Suite 430, Oregon City** for that purpose. Attendance will be documented through a sign-in sheet prepared by the County representative. Prime bidders who arrive more than ten (10) minutes after the start time of the meeting (as stated in the solicitation and by the County's watch) or after the discussion portion of the meeting (whichever comes first) shall not be permitted to sign in and will not be permitted to submit a bid on the project.

2. **Electronic Submissions:** The County is requiring all bids for this project be electronically submitted. Complete Bids (including all attachments) will only be accepted electronically thru a secure online bid submission service, Bid Locker. Email submissions to Clackamas County email addresses will no longer be accepted. https://bidlocker.us/a/clackamascounty/BidLocker.

Bids will be publicly read aloud via the computer application, Zoom. Bidders will be allowed to video conference or listen by phone to the bid results. The projects Zoom meeting can be accessed via the information below:

ZOOM LINKS
Join Zoom Meeting
https://clackamascounty.zoom.us/j/81116345886

Meeting ID: 811 1634 5886

One tap mobile
+16699006833,,81116345886# US (San Jose) 17193594580,,81116345886# US

Dial by your location
• +1 669 900 6833 US (San Jose)
• +1 719 359 4580 US
• +1 253 205 0468 US
• +1 253 215 8782 US (Tacoma)
• +1 346 248 7799 US (Houston)
• +1 408 638 0968 US (San Jose)
• +1 669 444 9171 US

• +1 564 217 2000 US
• +1 646 876 9923 US (New York)
• +1 646 931 3860 US
• +1 689 278 1000 US
• +1 301 715 8592 US (Washington DC)
• +1 305 224 1968 US
• +1 309 205 3325 US
• +1 312 626 6799 US (Chicago)
• +1 360 209 5623 US
• +1 386 347 5053 US
• +1 507 473 4847 US

Meeting ID: 811 1634 5886

Find your local number: https://clackamascounty.zoom.us/u/kbLMEla6Vq

**The Apparent Low bid results will be posted to the projects OregonBuys listing as soon as possible following the bid opening.

3. **Good Faith Effort:** Clackamas County encourages participation in contracts by Historically Underrepresented Businesses. "Historically Underrepresented Businesses" are State of Oregon-certified and self-identified minority, women and emerging small business as well as firms that are certified federally or by another state or entity with substantially similar requirements as the State of Oregon.

   Bidders must perform Good Faith Effort (defined below) and submit **Form 1 and Form 2** for the Bidders Bid to be considered responsive. **Form 1 and Form 2** must be submitted within **two (2) hours** after the Closing Date and Time. Form 1 and Form 2 may be submitted to either the Contact Information Analyst listed on Notice of Contract Opportunity or via the https://bidlocker.us/a/clackamascounty/BidLocker listing.

   "Good Faith Effort" is a requirement of a prime contractor to reach out to at least three Historically Underrepresented Business Subcontractors for each division of work that will be subcontracted out and to complete the required forms. If fewer than three Historically Underrepresented Business Subcontractors are reasonably available for a particular division of work, the Bidder must specifically note the reason for there being fewer than three contacts. The outreach should be performed with sufficient time to give the subcontractors at least 5 calendar days to respond to the opportunity. Form 3, which documents the actual amount of subcontractors on the project, must be submitted with the project final pay application. Compliance with the Good Faith Effort and submission of Forms 1, 2 and 3 is a contractual requirement for final payment.

   The sufficiency of the documentation or the performance of Good Faith Effort shall be in the sole and absolute determination of Clackamas County. Only those Bidders that Clackamas County has determined have not sufficiently performed Good Faith Effort shall have protest rights of the determination for such Bidder. No Bidder shall have protest rights of the sufficiency of any other Bidder completing Good Faith Effort.

CLACKAMAS COUNTY
GOOD FAITH EFFORT
SUBCONTRACTOR AND SELF-PERFORMED WORK LIST
(FORM 1)

Prime Contractor Name: Dewitt Construction Inc. **Total Contract Amount:**

Project Name: 2025-63 Pump Station Rehabilitation and Upgrades Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sieb Lane Pump Stations

PRIME SELF-PERFORMING: Identify below **ALL** GFE Divisions of Work (DOW) to be self-performed. Good Faith Efforts are otherwise required.

DOW BIDDER WILL SELF-PERFORM *(GFE not required)*	
Clearing & Grub	
Excavation / Earthwork	
Concrete	
Utilities (Site/Pipe)	
Framing	

PRIME CONTRACTOR SHALL DISCLOSE AND LIST ALL SUBCONTRACTORS, including those Minority-owned, Woman-owned, and Emerging Small Businesses ("M/W/ESB") that you intend to use on the project. Delivery via bid locker https://bidlocker.us/a/clackamascounty/BidLocker within 2 hours of the BID/Quote Closing Date/Time.

LIST ALL SUBCONTRACTORS BELOW Use **correct legal name** of Subcontractor (No Assumed Business Names)	**Division of Work** (Painting, electrical, landscaping, etc.) List **ALL** DOW performed by Subcontractors	**DOLLAR AMOUNT OF SUBCONTRACT**	If Certified or self-reporting MBE/WBE/ESB Subcontractor Check box ☑		
			MBE	WBE	ESB
Name Cutter Construction **Address** 21410 S Levi Road **City/St/Zip** Beaver Creek OR 97004 **Phone#** 503-969-5116 **OCCB#** 66797	Trucking	$56,110.00	☐	☑	☐
Name Dell Flagging **Address** 1621 SE Pardee St **City/St/Zip** Portland OR 97202 **Phone#** 503-232-2488 **OCCB#** 216371	Traffic Control	4,500.00	☐	☐	☐
Name AGA Asphalting **Address** 12414 NE 99th St **City/St/Zip** Vancouver WA. 98682 **Phone#** 360-836-8468 **OCCB#** 221185	HMAC	$80,879.75	☐	☐	☐
Name Columbia Gorge Sheet Metal LLC **Address** 3926 Wy'East Rd. **City/St/Zip** Hood River OR. 97031 **Phone#** 541-645-4845 **OCCB#** 254825	Metal Roofing Wall & Underlayment	$17,600.00	☐	☐	☐

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GFE SUBCONTRACTOR AND SELF-PERFORMED WORK LIST (FORM 1) cont'd

Prime Contractor Name: Dewitt Construction Inc **Total Contract Amount:**
Project Name: 2025-63 Pump Station Rehabilitation and Upgrad
Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, a
Sieben Lane Pump Stations

LIST ALL SUBCONTRACTORS BELOW Use correct legal name of Subcontractor (No Assumed Business Names)	Division of Work (Painting, electrical, landscaping, etc.) List ALL DOW performed by Subcontractors	DOLLAR AMOUNT OF SUBCONTRACT	If Certified or self-reporting MBE/WBE/ESB Subcontractor Check box ☑		
			MBE	WBE	ESB
Name Santiam Heating & Sheetmetal Inc. **Address** 41713 Stayton Scio Rd **City/St/Zip** Stayton Oregon 97383 **Phone#** 503-769-8483 **OCCB#** 104080	HVAC	$23,600.00	☐	☐	☐
Name Fox Erosion & Landscape, Inc **Address** 11091 Hwy 212 **City/St/Zip** Clackamas OR 97015 **Phone#** 503 654-8816 **OCCB#** LCB.7393	Landscape	$9,000.00	☐	☑	☐
Name Molecular Inc **Address** 157 McMillan Dr **City/St/Zip** Longview WA. 98632 **Phone#** 360-749-8200 **OCCB#** 121211	Epoxy Coatings	$127,800.00	☐	☐	☐
Name Magnum Masonry Inc **Address** 20701 S. Wisteria Rd **City/St/Zip** West Linn, OR. 97068 **Phone#** 503-869-9166 **OCCB#** 175123	CMU Block Walls	$16,800.00	☐	☐	☐
Name Brothers Concrete Cutting, **Address** 1721 Fescue St. SE **City/St/Zip** Albany OR. 97322 **Phone#** 503-635-1133 **OCCB#** 48661	Sawcutting/ Conc. Coring	$20,285.00	☑	☐	☐
Name Rose City Labratories **Address** 7200 SE Johnson Creek Blvd. **City/St/Zip** Portland OR 97206 **Phone#** 503-307-0096 **OCCB#**	Asbestos Survey	$1,600.00	☐	☐	☐
Name Town & Country Fence **Address** PO Box 443 **City/St/Zip** Clackamas OR. 9705 **Phone#** 503-655-2055 **OCCB#** 7247	Fence/Gates	$39,116.00	☐	☐	☐

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Prime Contractor Name: **Total Contract Amount:**

Project Name: 2025-63 Pump Station Rehabilitation and Upgrad
Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, a
Sieben Lane Pump Stations

LIST ALL SUBCONTRACTORS BELOW Use **correct legal name** of Subcontractor (No Assumed Business Names)	**Division of Work** (Painting, electrical, landscaping, etc.) List **ALL** DOW performed by Subcontractors	**DOLLAR AMOUNT OF SUBCONTRACT**	If Certified or self-reporting MBE/WBE/ESB Subcontractor Check box ☑		
			MBE	WBE	ESB
Name Applied Technical Systems **Address** 2019 NE Colwin Court **City/St/Zip** McMinnville OR. **Phone#** 503 472-4003 **OCCB#** 89571	Electrician	$940,207.00	☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐

CLACKAMAS COUNTY
GOOD FAITH EFFORT
M/W/ESB CONTACT / BIDS RECEIVED LOG
(FORM 2)

Prime Contractor: Dewitt Construction Inc.
Project: 2025-63 Pump Station Rehabilitation and Upgrades Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sleben Lane Pump Stations

Prime Contractor must contact or endeavor to contact at least 3 M/W/ESB Subcontractors for each Division of Work. Prime Contractor shall record its contacts with M/W/ESB Subcontractors through use of this log (or equivalent) entering all required information. All columns shall be completed where applicable. Additional forms may be copied if needed.

NAME OF M/W/ESB SUBCONTRACTOR	Divisions of Work (Painting, electrical, landscaping, etc.)	Date Solicitation Letter / Fax Sent	PHONE CONTACT		BID ACTIVITY Check Yes or No			REJECTED BIDS (if bid received & not used)		Notes
			Date of Call	Person Receiving Call	Will Bid	Bid Received	Bid Used	Bid Amount	Reason Not Used (Price, Scope or Other. If Other, explain in Notes>>)	
LALONDE ELECTRIC	ELECTRICAL		8/11	BRUCE LALONDE	☑ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
Cutsforth Construction	Trucking		8/12	LORNE	☑ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
Brothers Concrete Cutting	Saw cutting Core drill		8/12	CHRIS	☑ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
Johnny's Concreting LLC	CMC work	BMAil	8/18	J Hon	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			

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CLACKAMAS COUNTY
GOOD FAITH EFFORT
PROJECT COMPLETION REPORT
(FORM 3)

Prime Contractor Name: David Construction Inc. **Total Contract Amount:**
Project Name: 2025-63 Pump Station Rehabilitation and Upgrades Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sieben Lane Pump Stations

Complete this form and submit with your request for final payment upon the project completion. Please list all subcontractors used for the project. Use additional sheets as necessary.

LIST ALL SUBCONTRACTORS BELOW Use correct legal name of Subcontractor (No Assumed Business Names)	Division of Work (Painting, electrical, landscaping, etc.) List ALL DOW performed by Subcontractors	FINAL DOLLAR AMOUNT OF SUBCONTRACT	If Certified or self-reported MBE/WBE/ESB Subcontractor Check box ☑		
			MBE	WBE	ESB
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐
Name **Address** **City/St/Zip** **Phone#** **OCCB#**			☐	☐	☐

BY SIGNING BELOW, I HEREBY CERTIFY THAT THE ABOVE LISTED FIRMS HAVE BEEN UTILIZED BY OUR COMPANY IN THE AMOUNTS REPRESENTED ABOVE AND THAT THE INFORMATION CONTAINED HEREIN IS COMPLETE AND ACCURATE. .

Authorized Signature of Contractor Representative

Date

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CLACKAMAS WATER ENVIRONMENT SERVICES

PUBLIC IMPROVEMENT CONTRACT

BID BOND

Project Name: # 2025-63
Pump Station Rehabilitation and Upgrades Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sieben Lane Pump Stations

We, DeWitt Construction, Inc., as "Principal,"
(Name of Principal)

and Markel Insurance Company, an Illinois Corporation,
(Name of Surety)

authorized to transact Surety business in Oregon, as "Surety," hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns to pay unto Water Environment Services ("Obligee") the sum of ($ 10% of Bid Amount)

Ten Percent (10%) of Bid Amount dollars.

WHEREAS, the condition of the obligation of this bond is that Principal has submitted its proposal or bid to an agency of the Obligee in response to Obligee's procurement document (No. 2025-63) for the project identified above which proposal or bid is made a part of this bond by reference, and Principal is required to furnish bid security in an amount equal to ten (10%) percent of the total amount of the bid pursuant to the procurement document.

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

IN WITNESS WHEREOF, we have caused this instrument to be executed and sealed by our duly authorized legal representatives this 21st day of August, 2025.

Principal: DeWitt Construction, Inc.

By: _____
Signature

President
Official Capacity

Attest: _____
Corporation Secretary

Surety: Markel Insurance Company

By: Attorney-in-Fact

Travis J. Robles
Name

1111 Main Street #640
Address

Vancouver, WA 98660
City State Zip

804-747-0136 Phone

804-527-7905 Fax

MARKEL INSURANCE COMPANY CORPORATE SEAL ILLINOIS

Clackamas County Contract Form B-4 (1/2017)

POA# 4710014

JOINT LIMITED POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That SureTec Insurance Company, a Corporation duly organized and existing under the laws of the State of Texas and having its principal office in the County of Harris, Texas and Markel Insurance Company (the "Company"), a corporation duly organized and existing under the laws of the state of Illinois, and having its principal administrative office in Glen Allen, Virginia, does by these presents make, constitute and appoint:

Aliceon A. Keltner, Annelies M. Richie, Carley Espiritu, Christopher Kinyon, Jamie L. Marques, Holli Lagerquist, Tamara A. Ringeisen, Katharine J. Snider, Amelia G. Burrill, Justin Dean Price, Lindsey Elaine Jorgensen, Lois F. Weathers, Sarah Whitaker, Julie A. Craker, Charla M. Boadle, Travis J. Robles

Their true and lawful agent(s) and attorney(s)-in-fact, each in their separate capacity if more than one is named above, to make, execute, seal and deliver for and on their own behalf, individually as a surety or jointly, as co-sureties, and as their act and deed any and all bonds and other undertaking in suretyship provided, however, that the penal sum of any one such instrument executed hereunder shall not exceed the sum of:

Fifty Million and 00/100 Dollars ($50,000,000.00)

This Power of Attorney is granted and is signed and sealed under and by the authority of the following Resolutions adopted by the Board of Directors of SureTec Insurance Company and Markel Insurance Company:

"RESOLVED, That the President, any Senior Vice President, Vice President, Assistant Vice President, Secretary, Assistant Secretary, Treasurer or Assistant Treasurer and each of them hereby is authorized to execute powers of attorney, and such authority can be executed by use of facsimile signature, which may be attested or acknowledged by any officer or attorney, of the company, qualifying the attorney or attorneys named in the given power of attorney, to execute in behalf of, and acknowledge as the act and deed of the SureTec Insurance Company and Markel Insurance Company, as the case may be, all bond undertakings and contracts of suretyship, and to affix the corporate seal thereto."

IN WITNESS WHEREOF, Markel Insurance Company and SureTec Insurance Company have caused their official seal to be hereunto affixed and these presents to be signed by their duly authorized officers on the 6th day of June , 2025 .

SureTec Insurance Company

By: _____
Michael C. Keimig, President

SURETEC INSURANCE COMPANY TEXAS

MARKEL INSURANCE CORPORATE COMPANY SEAL ILLINOIS

Markel Insurance Company

By: _____
Lindey Jennings, Vice President

State of Texas
County of Harris:

On this 6th day of June , 2025 A. D., before me, a Notary Public of the State of Texas, in and for the County of Harris, duly commissioned and qualified, came THE ABOVE OFFICERS OF THE COMPANIES, to me personally known to be the individuals and officers described in, who executed the preceding instrument, and they acknowledged the execution of same, and being by me duly sworn, disposed and said that they are the officers of the said companies aforesaid, and that the seals affixed to the proceeding instrument are the Corporate Seals of said Companies, and the said Corporate Seals and their signatures as officers were duly affixed and subscribed to the said instrument by the authority and direction of the said companies, and that Resolutions adopted by the Board of Directors of said Companies referred to in the preceding instrument is now in force.

IN TESTIMONY WHEREOF, I have hereunto set my hand, and affixed my Official Seal at the County of Harris, the day and year first above written.

JULIE E. MCCLARY
Notary Public State of Texas
Commission # 12947680-5
Commission Expires March 29, 2026

By: _____
Julie E. McClary, Notary Public
My commission expires 3/29/2026

We, the undersigned Officers of SureTec Insurance Company and Markel Insurance Company do herby certify that the original POWER OF ATTORNEY of which the foregoing is a full, true and correct copy is still in full force and effect and has not been revoked.

IN WITNESS WHEREOF, we have hereunto set our hands, and affixed the Seals of said Companies, on the 21st day of August , 2025 .

SureTec Insurance Company

By: _____
M. Brent Beaty, Assistant Secretary

MARKEL INSURANCE CORPORATE COMPANY SEAL ILLINOIS

Markel Insurance Company

By: _____
Andrew Marquis, Assistant Secretary

Any Instrument Issued in excess of the penalty stated above is totally void and without any validity. **4710014**
For verification of the authority of this Power you may call (713)812-0800 on any business day between 8:30 AM and 5:00 PM CST.

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

BID FORM

PROJECT: 2025-63 Pump Station Rehabilitation and Upgrades Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sieben Lane Pump Stations
BID CLOSING: August 21, 2025, 2:00 PM, Pacific Time
BID OPENING: August 21, 2025, 2:05 PM, Pacific Time

FROM: Dewitt Construction Inc.
Bidder's Name (must be full legal name, not ABN/DBA)

TO: https://bidlocker.us/a/clackamascounty/BidLocker

1. Bidder is (*check one of the following and insert information requested*):

____a. An individual; or

____b. A partnership registered under the laws of the State of _____; or

__X__c. A corporation organized under the laws of the State of Oregon; or

____d. A limited liability corporation organized under the laws of the State of _____;

and authorized to do business in the State of Oregon hereby proposes to furnish all material and labor and perform all work hereinafter indicated for the above project in strict accordance with the Contract Documents for the Basic Bid as follows:

Three million four hundred eight thousand two hundred fifty three Dollars ($ 3,408,253.00)

and the Undersigned agrees to be bound by the following documents:

- Notice of Public Improvement Contract Opportunity
- Instructions to Bidders
- Bid Bond
- Public Improvement Contract Form
- Clackamas County General Conditions
- Prevailing Wage Rates
- Plans, Specifications and Drawings
- Supplemental Instructions to Bidders
- Bid Form
- Performance Bond and Payment Bond
- Supplemental General Conditions
- Payroll and Certified Statement Form

- ADDENDA numbered 1 through 2, inclusive *(fill in blanks)*

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2. The Undersigned proposes to add to or deduct from the Base Bid indicated above the items of work relating to the following Alternate(s) as designated in the Specifications: **N/A**

3. The Undersigned proposes to add to or deduct from the Base Bid indicated above the items or work relating to the following Unit Price(s) as designated in the Specifications, for which any adjustments in the Contract amount will be made in accordance with Section D of the Clackamas County General Conditions: **Provide attached bid schedule with bid.**

4. The work shall be completed within the time stipulated and specified in the contract documents.

5. Accompanying herewith is Bid Security which is equal to ten percent (10%) of the total amount of the Basic Bid, plus the total sum of all Alternatives (if any).

6. The Undersigned agrees, if awarded the Contract, to execute and deliver to Clackamas County, within twenty (20) calendar days after receiving the Contract forms, a Contract Form, and a satisfactory Performance Bond and Payment Bond each in an amount equal to one hundred percent (100%) of the Contract sum, using forms provided by the Owner. The surety requested to issue the Performance Bond and Payment Bond will be:

MARKEL INSURANCE COMPANY

(name of surety company - not insurance agency)

The Undersigned hereby authorizes said surety company to disclose any information to the Owner concerning the Undersigned's ability to supply a Performance Bond and Payment Bond each in the amount of the Contract.

7. The Undersigned further agrees that the Bid Security accompanying the Bid is left in escrow with Clackamas County; that the amount thereof is the measure of liquidated damages which the Owner will sustain by the failure of the Undersigned to execute and deliver the above-named Contract Form, Performance Bond and Payment Bond, each as published, and that if the Undersigned defaults in either executing the Contract Form or providing the Performance Bond and Payment Bond within twenty (20) calendar days after receiving the Contract forms, then the Bid Security shall become the property of the Owner at the Owner's option; but if the Bid is not accepted within thirty (30) calendar days of the time set for the opening of the Bids, or if the Undersigned executes and timely delivers said Contract Form, Performance Bond and Payment Bond, the Bid Security shall be returned.

8. The Undersigned certifies that: (i) This Bid has been arrived at independently and is being submitted without collusion with and without any agreement, understanding, or planned common course of action with any other vendor of materials, supplies, equipment or services described in the invitation to bid designed to limit independent bidding or competition; and (ii) the contents of the Bid have not been communicated by the Undersigned or its employees or agents to any person not an employee or agent of the Undersigned or its surety on any Bond furnished with the Bid and will not be communicated to such person prior to the official opening of the Bid.

9. The undersigned ☒ **HAS,** ☐ **HAS NOT** (*check one*) paid unemployment or income taxes in Oregon within the past 12 months and ☐ **DOES,** ☒ **DOES NOT** (*check one*) a business address in Oregon. The undersigned acknowledges that, if the selected bidder, that the undersigned will have to pay all applicable taxes and register to do business in the State of Oregon before executing the Contract Form.

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10. The Undersigned agrees, if awarded a contract, to comply with the provisions of ORS 279C.800 through 279C.870 pertaining to the payment of the prevailing rates of wage.

11. Contractor's CCB registration number is 63072. As a condition to submitting a bid, a Contractor must be registered with the Oregon Construction Contractors Board in accordance with ORS 701.035 to 701.055, and disclose the registration number. Failure to register and disclose the number will make the bid unresponsive and it will be rejected, unless contrary to federal law.

12. The successful Bidder hereby certifies that all subcontractors who will perform construction work as described in ORS 701.005(2) were registered with the Construction Contractors Board in accordance with ORS 701.035 to 701.055 at the time the subcontractor(s) made a bid to work under the contract.

13. The successful Bidder hereby certifies that, in compliance with the Worker's Compensation Law of the State of Oregon, its Worker's Compensation Insurance provider is SAIF, Policy No. 737761, and that Contractor shall submit Certificates of Insurance as required.

14. Contractor's Key Individuals for this project (supply information as applicable):

Project Executive: Ty Dewitt, Cell Phone: 503-781-7690,
Project Manager: Rob Richardson, Cell Phone: 360-600-3446,
Job Superintendent: Ron Apger, Cell Phone: 360-601-4677,
Project Engineer: _____, Cell Phone: _____.

15. The Undersigned certifies that it has not discriminated against minority, women, or emerging small businesses in obtaining any subcontracts for this project.

16. The Undersigned certifies that it has a drug testing program in accordance with ORS 279C.505.

REMINDER: Bidder must submit the below First-Tier Subcontractor Disclosure Form.

By signature below, Contractor agrees to be bound by this Bid.

NAME OF FIRM Dewitt Construction Inc.

ADDRESS 10311 NE 72nd Ave
Vancouver WA 98686

TELEPHONE NO 360-576-8755

EMAIL ty@dewittconst.com

SIGNATURE 1) _____
Sole Individual

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or 2) _____
Partner

or 3) _____
Authorized Officer or Employee of Corporation

* * * * * *END OF BID* * * * * *

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Group 3 Pump Station Upgrades Bid Tab					
Schedule A - South Welches Pump Station					
Item No.	Description	Total	Unit	Unit Price	Total Price
A-1	Mobilization, Bonds, Insurance and Demobilization	1	LS	120,500.00	120,500.00
A-2	Erosion and Sediment Control	1	LS	14,181.00	14,181.00
A-3	Bypassing	1	LS	52,532.00	52,532.00
A-4	Existing Pump Station Demolition	1	LS	39,446.00	39,446.00
A-5	Pump Station Upgrades, Complete	1	LS	717,303.00	717,303.00
A-6	Asbestos Survey	1	LS	441.00	441.00
A-7	Asbestos Removal and Disposal Allowance	1	F-A	$ 10,000	$10,000
Schedule B - Golf Club Terrace Pump Station					
Item No.	Description	Total	Unit	Unit Price	Total Price
B-1	Mobilization, Bonds, Insurance and Demobilization	1	LS	99,384.00	99,384.00
B-2	Erosion and Sediment Control	1	LS	2,857.00	2,857.00
B-3	Bypassing	1	LS	40,413.00	40,413.00
B-4	Existing Pump Station Demolition	1	LS	31,827.00	31,827.00
B-5	Pump Station Upgrades, Complete	1	LS	644,834.00	644,834.00
B-6	Asbestos Survey	1	LS	441.00	441.00
B-7	Asbestos Removal and Disposal Allowance	1	F-A	$ 15,000	$15,000
Schedule C - 82nd Drive Pump Station					
Item No.	Description	Total	Unit	Unit Price	Total Price
C-1	Mobilization, Bonds, Insurance and Demobilization	1	LS	86,400.00	86,400.00
C-2	Erosion and Sediment Control	1	LS	2920.00	2920.00
C-3	Bypassing	1	LS	68580.00	68580.00
C-4	Existing Pump Station Demolition	1	LS	27,846.00	27,846.00
C-5	Pump Station Upgrades, Complete	1	LS	462,555.00	462,555.00
C-6	Asbestos Survey	1	LS	331.00	331.00
C-7	Asbestos Removal and Disposal Allowance	1	F-A	$ 15,000	$15,000
Schedule D - Sieben Lane Pump Station					
Item No.	Description	Total	Unit	Unit Price	Total Price
D-1	Mobilization, Bonds, Insurance and Demobilization	1	LS	98,186.00	98,186.00
D-2	Erosion and Sediment Control	1	LS	4484.00	4484.00
D-3	Bypassing	1	LS	47,648.00	47,648.00
D-4	Existing Pump Station Demolition	1	LS	14,895.00	14,895.00
D-5	Pump Station Upgrades, Complete	1	LS	694,900.00	694,900.00
D-6	Asbestos Survey	1	LS	331.00	331.00
D-7	Asbestos Removal and Disposal Allowance	1	F-A	$ 15,000	$15,000
				TOTAL	

Bid Total numerically: $ 3,408,253.00

Bid Total written in words: THREE MILLION, FOUR HUNDRED-EIGHT THOUSAND, TWO HUNDRED FIFTY THREE Dollars

Company Name: Dewitt Construction Inc.

Authorized Signature: Ty Dewitt

Printed name: Ty Dewitt

Date: 8-21-2025

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FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM
PROJECT: 2025-63

BID OPENING: August 21, 2025, 2:00 PM, Pacific Time

Failure to submit this Form by the disclosure deadline will result in a nonresponsive bid.

INSTRUCTIONS:
This First-Tier Subcontractor Disclosure Form ("Form") must be submitted and received at the location specified in the Notice of Public Improvement Contract Opportunity on the advertised Bid Closing, and within two working hours after the advertised Bid Closing Time.

Proposals will only be accepted electronically thru a secure online bid submission service, **Bid Locker**. *Email submissions to Clackamas County email addresses will no longer be accepted.*

A. Completed proposal documents must arrive electronically via Bid Locker located at https://bidlocker.us/a/clackamascounty/BidLocker.
B. Bid Locker will electronically document the date and time of all submissions. Completed documents must arrive by the deadline indicated in Section 1 or as modified by Addendum. LATE PROPOSALS WILL NOT BE ACCEPTED.
C. Proposers must register and create a profile for their business with Bid Locker in order to submit for this project. It is free to register for Bid Locker.
D. Proposers with further questions concerning Bid Locker may review the Vendor's Guide located at https://www.clackamas.us/how-to-bid-on-county-projects .

Subcontractor lists may be submitted with the bid in the same envelope or email at the Bid Closing date and time. Subcontractor lists **MUST** be submitted within **two (2) hours** of the Bid Closing date and time.

List below the name of each subcontractor that will be furnishing labor, or labor and materials, for which disclosure is required, the category of work that the subcontractor will be performing, and the dollar value of the subcontract. Enter **"NONE"** if the value of the project bid is less than $100,000 or there are no subcontractors that need to be disclosed. ATTACH ADDITIONAL SHEETS IF NECESSARY.

	SUBCONTRACTOR NAME	DOLLAR VALUE	CATEGORY OF WORK
1.	ATS (Applied Technical Systems	$940,207.00	Electrical
2.	Town & Country Fence Co	39,116.00	Fence & Gates
3.			
4.			
5.			
6.			

The above listed first-tier subcontractor(s) are providing labor, or labor and material, with a Dollar Value equal to or greater than:

a) 5% of the total Contract Price, but at least $15,000. If the Dollar Value is less than $15,000 do not list the subcontractor above; or
b) $350,000 regardless of the percentage of the total Contract Price.

Firm Name: Dewitt Construction Inc

Bidder Signature: [signature] Corp Secretary Phone # 360-576-8755

Type text here

FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM
PROJECT: 2025-63

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B. Bid Locker will electronically document the date and time of all submissions. Completed documents must arrive by the deadline indicated in Section 1 or as modified by Addendum. LATE PROPOSALS WILL NOT BE ACCEPTED.
C. Proposers must register and create a profile for their business with Bid Locker in order to submit for this project. It is free to register for Bid Locker.
D. Proposers with further questions concerning Bid Locker may review the Vendor's Guide located at https://www.clackamas.us/how-to-bid-on-county-projects .

Subcontractor lists may be submitted with the bid in the same envelope or email at the Bid Closing date and time. Subcontractor lists **MUST** be submitted within **two (2) hours** of the Bid Closing date and time.

List below the name of each subcontractor that will be furnishing labor, or labor and materials, for which disclosure is required, the category of work that the subcontractor will be performing, and the dollar value of the subcontract. Enter **"NONE"** if the value of the project bid is less than $100,000 or there are no subcontractors that need to be disclosed. ATTACH ADDITIONAL SHEETS IF NECESSARY.

	SUBCONTRACTOR NAME	DOLLAR VALUE	CATEGORY OF WORK
1.	ACA Asphalting	$ 80,871.75	Asphalt Paving
2.	Magnum Masonry	$ 16,800.00	CMU Block Walls
3.	Santiam Heating	$ 23,600.00	HVAC
4.	Molecular Inc.	$ 127,800.00	Epoxy Coatings
5.	Columbia Gorge Sheet Metal	$ 17,600.00	Metal Roofing, Wall, Underlayment
6.	Brothers Concrete Cutting	$ 20,285.00	Sawcutting / Core drilling

The above listed first-tier subcontractor(s) are providing labor, or labor and material, with a Dollar Value equal to or greater than:

a) 5% of the total Contract Price, but at least $15,000. If the Dollar Value is less than $15,000 do not list the subcontractor above; or
b) $350,000 regardless of the percentage of the total Contract Price.

Firm Name: Dewitt Construction Inc.

Bidder Signature: _____ Phone # 360-576-8755

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MARKEL

Bond No. 4485088

Bond in Lieu of Retainage

KNOW ALL MEN BY THESE PRESENTS, that we, Dewitt Construction, Inc. as Principal, and SureTec Insurance Company, 2103 Citywest Blvd., Houston, Texas 77042, *(address)*, as Surety, are held and firmly bound unto Water Envirnoment Services as Obligee, in the sum of One Hundred Seventy Thousand Four Hundred Twelve and 65/100 Dollars ($170,412.65), lawful money in the United States of America, to the payment of which, well and truly to be paid, we bind ourselves, our heirs, executors and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, That WHEREAS, on 10/24/2025 the Principal and Obligee entered into a contract for the construction of 2025-63 Pump Station Rehabilitation and Upgrades Project Group 3-South Welches Golf Club Terrace, 82nd Ave, and Sieben Ln Pump Stations and;

WEHREAS, Obligee has elected to withhold from funds due or about to become due, the Principal such sum as is necessary to protect itself from claim or claims unless Principal furnishes a Surety Bond guaranteeing to hold Obligee harmless from all loss it may suffer by reason of its releasing retainage to the Principal.

NOW, THEREFORE, if the Principal shall indemnify the Obligee from all loss which Obligee may suffer by virtue of release of retainage to Principal, then this obligation to be null and void, otherwise to be in full force and effect.

PROVIDED, HOWEVER: It is expressly understood and agreed that:

1. Any suit of action hereunder must be brought within 90 days of the date a proper court has rendered its decision on the validity and enforceability of the claim.
2. The laws of the State of Oregon shall be applicable in the determination of the rights and obligations of the parties hereunder.
3. No right of action shall accrue upon or by reason hereof to, or for the use or benefit of anyone other than the Obligee herein named.

IN WITNESS WHEREOF, said Principal and Surety have hereunto set their hands and seals this 28th day of October, 2025.

DEWITT CONSTRUCTION, INC CORPORATE SEAL OREGON

Principal: Dewitt Construction, Inc.

By: _____
DALE LINDSTROM – RISK & SAFETY MANAGER

Surety: SureTec Insurance Company

By: _____
Travis J. Robles, Attorney-in-Fact

POA# 4710014

JOINT LIMITED POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That SureTec Insurance Company, a Corporation duly organized and existing under the laws of the State of Texas and having its principal office in the County of Harris, Texas and Markel Insurance Company (the "Company"), a corporation duly organized and existing under the laws of the state of Illinois, and having its principal administrative office in Glen Allen, Virginia, does by these presents make, constitute and appoint:

Aliceon A. Keltner, Annelies M. Richie, Carley Espiritu, Christopher Kinyon, Jamie L. Marques, Holli Lagerquist, Tamara A. Ringeisen, Katharine J. Snider, Amelia G. Burrill, Justin Dean Price, Lindsey Elaine Jorgensen, Lois F. Weathers, Sarah Whitaker, Julie A. Craker, Charla M. Boadle, Travis J. Robles

Their true and lawful agent(s) and attorney(s)-in-fact, each in their separate capacity if more than one is named above, to make, execute, seal and deliver for and on their own behalf, individually as a surety or jointly, as co-sureties, and as their act and deed any and all bonds and other undertaking in suretyship provided, however, that the penal sum of any one such instrument executed hereunder shall not exceed the sum of:

Fifty Million and 00/100 Dollars ($50,000,000.00)

This Power of Attorney is granted and is signed and sealed under and by the authority of the following Resolutions adopted by the Board of Directors of SureTec Insurance Company and Markel Insurance Company:

"RESOLVED, That the President, any Senior Vice President, Vice President, Assistant Vice President, Secretary, Assistant Secretary, Treasurer or Assistant Treasurer and each of them hereby is authorized to execute powers of attorney, and such authority can be executed by use of facsimile signature, which may be attested or acknowledged by any officer or attorney, of the company, qualifying the attorney or attorneys named in the given power of attorney, to execute in behalf of, and acknowledge as the act and deed of the SureTec Insurance Company and Markel Insurance Company, as the case may be, all bond undertakings and contracts of suretyship, and to affix the corporate seal thereto."

IN WITNESS WHEREOF, Markel Insurance Company and SureTec Insurance Company have caused their official seal to be hereunto affixed and these presents to be signed by their duly authorized officers on the 6th day of June , 2025 .

SureTec Insurance Company

By: _____
Michael C. Keimig, President

SURETEC INSURANCE COMPANY — HOUSTON, TEXAS

MARKEL INSURANCE CORPORATE SEAL COMPANY — ILLINOIS

Markel Insurance Company

By: _____
Lindey Jennings, Vice President

State of Texas
County of Harris:

On this 6th day of June , 2025 A. D., before me, a Notary Public of the State of Texas, in and for the County of Harris, duly commissioned and qualified, came THE ABOVE OFFICERS OF THE COMPANIES, to me personally known to be the individuals and officers described in, who executed the preceding instrument, and they acknowledged the execution of same, and being by me duly sworn, disposed and said that they are the officers of the said companies aforesaid, and that the seals affixed to the proceeding instrument are the Corporate Seals of said Companies, and the said Corporate Seals and their signatures as officers were duly affixed and subscribed to the said instrument by the authority and direction of the said companies, and that Resolutions adopted by the Board of Directors of said Companies referred to in the preceding instrument is now in force.

IN TESTIMONY WHEREOF, I have hereunto set my hand, and affixed my Official Seal at the County of Harris, the day and year first above written.

NOTARY PUBLIC STATE OF TEXAS

JULIE E. MCCLARY
Notary Public State of Texas
Commission # 12947680-5
Commission Expires March 29, 2026

By: _____
Julie E. McClary, Notary Public
My commission expires 3/29/2026

We, the undersigned Officers of SureTec Insurance Company and Markel Insurance Company do herby certify that the original POWER OF ATTORNEY of which the foregoing is a full, true and correct copy is still in full force and effect and has not been revoked.

IN WITNESS WHEREOF, we have hereunto set our hands, and affixed the Seals of said Companies, on the 28th day of October , 2025 .

SureTec Insurance Company

By: _____
M. Brent Beaty, Assistant Secretary

Markel Insurance Company

By: _____
Andrew Marquis, Assistant Secretary

Any Instrument Issued in excess of the penalty stated above is totally void and without any validity. 4710014
For verification of the authority of this Power you may call (713)812-0800 on any business day between 8:30 AM and 5:00 PM CST.

EXHIBIT B

AIA® Document A312™ – 2010

Performance Bond

Bond Number: 4485048

CONTRACTOR:
(Name, legal status and address)
DeWitt Construction, Inc.

13023 NE Hwy 99, Suite 7, PMB 201
Vancouver, WA 98686

SURETY:
(Name, legal status and principal place of business)
Markel Insurance Company
1111 Main St. #640
Vancouver, WA 98660

OWNER:
(Name, legal status and address)
City of Longview
P.O. Box 128
Longview, WA 98632

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

CONSTRUCTION CONTRACT
Date:

Amount: Three Million Two Hundred Eight Thousand Eight Hundred Fifty-four & 73/100 ($3,208,854.73)

Description:
(Name and location)
Mt. Solo Reservoir Fill Line; Project No. 02136; Contract #25-0213-W

Reg Smith Drive in Roy Morse Park, Longview, WA.

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: Three Million Two Hundred Eight Thousand Eight Hundred Fifty-four & 73/100 ($3,208,854.73)

Modifications to this Bond: ☒ None ☐ See Section 16

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
DeWitt Construction, Inc.
Signature: Dale Lindstrom
Name DALE LINDSTROM
and Title: RISK & SAFETY MGR

SURETY
Company: *(Corporate Seal)*
Markel Insurance Company
Signature:
Name Travis J. Robles
and Title: Attorney-in-Fact

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or BROKER:
Propel Insurance
805 SW Broadway, Suite 2300
Portland, OR 97205-3363
503-467-7540

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

DEWITT CONSTRUCTION, INC. CORPORATE SEAL OREGON

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature: NA		Signature: NA	
Name and Title:		Name and Title:	
Address		Address	

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

POA# 4710014

JOINT LIMITED POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That SureTec Insurance Company, a Corporation duly organized and existing under the laws of the State of Texas and having its principal office in the County of Harris, Texas and Markel Insurance Company (the "Company"), a corporation duly organized and existing under the laws of the state of Illinois, and having its principal administrative office in Glen Allen, Virginia, does by these presents make, constitute and appoint:

Aliceon A. Keltner, Annelies M. Richie, Carley Espiritu, Christopher Kinyon, Jamie L. Marques, Holli Lagerquist, Tamara A. Ringeisen, Katharine J. Snider, Amelia G. Burrill, Justin Dean Price, Lindsey Elaine Jorgensen, Lois F. Weathers, Sarah Whitaker, Julie A. Craker, Charla M. Boadle, Travis J. Robles

Their true and lawful agent(s) and attorney(s)-in-fact, each in their separate capacity if more than one is named above, to make, execute, seal and deliver for and on their own behalf, individually as a surety or jointly, as co-sureties, and as their act and deed any and all bonds and other undertaking in suretyship provided, however, that the penal sum of any one such instrument executed hereunder shall not exceed the sum of:

Fifty Million and 00/100 Dollars ($50,000,000.00)

This Power of Attorney is granted and is signed and sealed under and by the authority of the following Resolutions adopted by the Board of Directors of SureTec Insurance Company and Markel Insurance Company:

"RESOLVED, That the President, any Senior Vice President, Vice President, Assistant Vice President, Secretary, Assistant Secretary, Treasurer or Assistant Treasurer and each of them hereby is authorized to execute powers of attorney, and such authority can be executed by use of facsimile signature, which may be attested or acknowledged by any officer or attorney, of the company, qualifying the attorney or attorneys named in the given power of attorney, to execute in behalf of, and acknowledge as the act and deed of the SureTec Insurance Company and Markel Insurance Company, as the case may be, all bond undertakings and contracts of suretyship, and to affix the corporate seal thereto."

IN WITNESS WHEREOF, Markel Insurance Company and SureTec Insurance Company have caused their official seal to be hereunto affixed and these presents to be signed by their duly authorized officers on the 6th day of June , 2025 .

SureTec Insurance Company

By: _____
Michael C. Keimig, President

SURETEC INSURANCE COMPANY HOUSTON TEXAS

MARKEL INSURANCE COMPANY CORPORATE SEAL ILLINOIS

Markel Insurance Company

By: _____
Lindey Jennings, Vice President

State of Texas
County of Harris:

On this 6th day of June , 2025 A. D., before me, a Notary Public of the State of Texas, in and for the County of Harris, duly commissioned and qualified, came THE ABOVE OFFICERS OF THE COMPANIES, to me personally known to be the individuals and officers described in, who executed the preceding instrument, and they acknowledged the execution of same, and being by me duly sworn, disposed and said that they are the officers of the said companies aforesaid, and that the seals affixed to the proceeding instrument are the Corporate Seals of said Companies, and the said Corporate Seals and their signatures as officers were duly affixed and subscribed to the said instrument by the authority and direction of the said companies, and that Resolutions adopted by the Board of Directors of said Companies referred to in the preceding instrument is now in force.

IN TESTIMONY WHEREOF, I have hereunto set my hand, and affixed my Official Seal at the County of Harris, the day and year first above written.

JULIE E. MCCLARY
Notary Public State of Texas
Commission # 12947680-5
Commission Expires March 29, 2026

By: _____
Julie E. McClary, Notary Public
My commission expires 3/29/2026

We, the undersigned Officers of SureTec Insurance Company and Markel Insurance Company do herby certify that the original POWER OF ATTORNEY of which the foregoing is a full, true and correct copy is still in full force and effect and has not been revoked.

IN WITNESS WHEREOF, we have hereunto set our hands, and affixed the Seals of said Companies, on the 14th day of August, 2025.

SureTec Insurance Company

By: _____
M. Brent Beaty, Assistant Secretary

Markel Insurance Company

By: _____
Andrew Marquis, Assistant Secretary

Any Instrument Issued in excess of the penalty stated above is totally void and without any validity. 4710014
For verification of the authority of this Power you may call (713)812-0800 on any business day between 8:30 AM and 5:00 PM CST.

AIA Document A312™ – 2010

Payment Bond

Bond Number: 4485048

CONTRACTOR:
(Name, legal status and address)
DeWitt Construction, Inc.

13023 NE Hwy 99, Suite 7, PMB 201
Vancouver, WA 98686

SURETY:
(Name, legal status and principal place of business)
Markel Insurance Company
1111 Main St. #640
Vancouver, WA 98660

OWNER:
(Name, legal status and address)
City of Longview
P.O. Box 128
Longview, WA 98632

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

CONSTRUCTION CONTRACT
Date:

Amount: Three Million Two Hundred Eight Thousand Eight Hundred Fifty-four & 73/100 ($3,208,854.73)

Description:
(Name and location)
Mt. Solo Reservoir Fill Line; Project No. 02136; Contract #25-0213-W

Reg Smith Drive in Roy Morse Park, Longview, WA.

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: Three Million Two Hundred Eight Thousand Eight Hundred Fifty-four & 73/100 ($3,208,854.73)

Modifications to this Bond: ☒ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
DeWitt Construction, Inc.

Signature: Dale Lindstrom
Name and Title: DALE LINDSTROM RISK & SAFETY MGR

SURETY
Company: *(Corporate Seal)*
Markel Insurance Company

Signature:
Name Travis J. Robles
and Title: Attorney-in-Fact

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:
Propel Insurance
805 SW Broadway, Suite 2300
Portland, OR 97205-3363
503-467-7540

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

DEWITT CONSTRUCTION, INC. CORPORATE SEAL OREGON

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

.1 the name of the Claimant;
.2 the name of the person for whom the labor was done, or materials or equipment furnished;
.3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
.4 a brief description of the labor, materials or equipment furnished;
.5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
.6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
.7 the total amount of previous payments received by the Claimant; and
.8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature: NA		Signature: NA	
Name and Title:		Name and Title:	
Address		Address	

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

POA# 4710014

JOINT LIMITED POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That SureTec Insurance Company, a Corporation duly organized and existing under the laws of the State of Texas and having its principal office in the County of Harris, Texas and Markel Insurance Company (the "Company"), a corporation duly organized and existing under the laws of the state of Illinois, and having its principal administrative office in Glen Allen, Virginia, does by these presents make, constitute and appoint:

Aliceon A. Keltner, Annelies M. Richie, Carley Espiritu, Christopher Kinyon, Jamie L. Marques, Holli Lagerquist, Tamara A. Ringeisen, Katharine J. Snider, Amelia G. Burrill, Justin Dean Price, Lindsey Elaine Jorgensen, Lois F. Weathers, Sarah Whitaker, Julie A. Craker, Charla M. Boadle, Travis J. Robles

Their true and lawful agent(s) and attorney(s)-in-fact, each in their separate capacity if more than one is named above, to make, execute, seal and deliver for and on their own behalf, individually as a surety or jointly, as co-sureties, and as their act and deed any and all bonds and other undertaking in suretyship provided, however, that the penal sum of any one such instrument executed hereunder shall not exceed the sum of:

Fifty Million and 00/100 Dollars ($50,000,000.00)

This Power of Attorney is granted and is signed and sealed under and by the authority of the following Resolutions adopted by the Board of Directors of SureTec Insurance Company and Markel Insurance Company:

"RESOLVED, That the President, any Senior Vice President, Vice President, Assistant Vice President, Secretary, Assistant Secretary, Treasurer or Assistant Treasurer and each of them hereby is authorized to execute powers of attorney, and such authority can be executed by use of facsimile signature, which may be attested or acknowledged by any officer or attorney, of the company, qualifying the attorney or attorneys named in the given power of attorney, to execute in behalf of, and acknowledge as the act and deed of the SureTec Insurance Company and Markel Insurance Company, as the case may be, all bond undertakings and contracts of suretyship, and to affix the corporate seal thereto."

IN WITNESS WHEREOF, Markel Insurance Company and SureTec Insurance Company have caused their official seal to be hereunto affixed and these presents to be signed by their duly authorized officers on the 6th day of June , 2025 .

SureTec Insurance Company

By: _____
Michael C. Keimig, President

SURETEC INSURANCE COMPANY HOUSTON TEXAS

MARKEL INSURANCE COMPANY CORPORATE SEAL ILLINOIS

Markel Insurance Company

By: _____
Lindey Jennings, Vice President

State of Texas
County of Harris:

On this 6th day of June , 2025 A. D., before me, a Notary Public of the State of Texas, in and for the County of Harris, duly commissioned and qualified, came THE ABOVE OFFICERS OF THE COMPANIES, to me personally known to be the individuals and officers described in, who executed the preceding instrument, and they acknowledged the execution of same, and being by me duly sworn, disposed and said that they are the officers of the said companies aforesaid, and that the seals affixed to the proceeding instrument are the Corporate Seals of said Companies, and the said Corporate Seals and their signatures as officers were duly affixed and subscribed to the said instrument by the authority and direction of the said companies, and that Resolutions adopted by the Board of Directors of said Companies referred to in the preceding instrument is now in force.

IN TESTIMONY WHEREOF, I have hereunto set my hand, and affixed my Official Seal at the County of Harris, the day and year first above written.

JULIE E. MCCLARY
NOTARY PUBLIC STATE OF TEXAS
Notary Public State of Texas
Commission # 12947680-5
Commission Expires March 29, 2026

By: _____
Julie E. McClary, Notary Public
My commission expires 3/29/2026

We, the undersigned Officers of SureTec Insurance Company and Markel Insurance Company do herby certify that the original POWER OF ATTORNEY of which the foregoing is a full, true and correct copy is still in full force and effect and has not been revoked.

IN WITNESS WHEREOF, we have hereunto set our hands, and affixed the Seals of said Companies, on the 14th day of August 2025.

SureTec Insurance Company

By: _____
M. Brent Beaty, Assistant Secretary

Markel Insurance Company

By: _____
Andrew Marquis, Assistant Secretary

Any Instrument Issued in excess of the penalty stated above is totally void and without any validity. 4710014
For verification of the authority of this Power you may call (713)812-0800 on any business day between 8:30 AM and 5:00 PM CST.

EXHIBIT C

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

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requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

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recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

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33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

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43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

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1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

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F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

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into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

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ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

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inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

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B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

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established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

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D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

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B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

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and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

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Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

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3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

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or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

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of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

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conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

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Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

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Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

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L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

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4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

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Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

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6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

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B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

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2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

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3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

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H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

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7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

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7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

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I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

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3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

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document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

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d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

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9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

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D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

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E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

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B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

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9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

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ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

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ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

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B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

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1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:
   1. A mutually acceptable fixed fee; or
   2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
      a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
      b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
      c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
      d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
      e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
      f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

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11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

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Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

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and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

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2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

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consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

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g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

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Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

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thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

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D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

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losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

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or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

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establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

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4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

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b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

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submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

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significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

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d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

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appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

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provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

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18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

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

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT
PROJECT INFORMATION, PLANS, SPECIFICATIONS AND DRAWINGS

PROJECT: Pump Station Rehabilitation and Upgrades Project Group 3 - South Welches, Golf Club Terrace, 82nd Ave, and Sieben Lane Pump Stations

Background:

Water Environment Services ("WES") is a special district operating under an ORS 190 Partnership that produces clean water and protects water quality for more than 190,000 people living and working in Clackamas County, Oregon. WES owns and operates five resource recovery facilities, 23 pumping stations and more than 350 miles of pipes. WES serves the Cities of Milwaukie, Happy Valley, Oregon City, West Linn, Gladstone, Johnson City, and unincorporated areas within Clackamas County.

Project Scope:

The Work is generally described as follows:

A. Schedule A: South Welches Pump Station
Establishment of erosion and sediment control, tree protection, temporary golf ball netting and temporary construction fencing, demolition of existing building roof, wet well top slab, pumps, discharge piping, level sensors, valve vault, a section of existing force main, existing trees and a section of asphalt pavement, establishment of temporary bypass, installation of new building roof, HVAC, electrical and controls equipment, wet well top slab and upgrades, pumps, discharge piping, level sensors, precast bypass vault with permanent bypass port, precast valve vault, drain pipe between valve vault and wet well, yard hydrant, connection to existing force main, disconnect panel and cable trench between building and wet well, generator with concrete base, asphalt pavement, aggregate site surfacing, and bollards.

B. Schedule B: Golf Club Terrace Pump Station
Establishment of erosion and sediment control, demolition of existing wet well top slab, valve vault, cable box adjacent to wet well, control building, fencing and gate, overhead power service, trees, establishment of temporary bypass, installation of new building with water service, HVAC, electrical and controls equipment, aggregate site surfacing, wet well top slab with hatch, pumps, discharge piping, level sensors, precast valve vault with air release valve, precast bypass vault with permanent bypass port, disconnect panel and cable trench adjacent to wet well, generator with concrete base, fence gates, bollards, replacement fencing and utility gate and connection to existing force main.

C. Schedule C: 82nd Ave Pump Station
Establishment erosion and sediment control, demolition of the existing wet well fiberglass enclosure, pumps, discharge piping and connection to existing force main, above ground control and power panels, trees, relocation of existing antenna pole, establishment of temporary bypass, installation of new wet well top risers and slab with hatch, pumps, discharge piping, precast valve vault, precast bypass vault with permanent bypass, drain pipe between valve vault and wet well, disconnect panel and cable trench

adjacent to wet well, power and control panels, aggregate site surfacing, brush clearing, generator with concrete base, establishing a fenced perimeter around the site with a large utility gate and man gate, and connection to existing force main.

D. Schedule D: Sieben Lane Pump Station
Establishment of erosion and sediment control, establishment of temporary bypass, demolition of existing pumps, discharge piping, HVAC, wet well and valve vault top slabs, disconnect panel and cable trench adjacent to wet well, asphalt pavement, installation of new electrical equipment, generator with concrete base, submersible level controls, pumps, discharge piping, wet well and valve vault top slabs with hatches, water service with RPBA and meter relocation, asphalt pavement and replacement of antenna pole mounted light.

Engineers Estimate: $4,110,000.00

Key Dates:
Substantial Completion 500 days after NTP
Final Completion 560 days after NTP
Parts of the Work must be substantially completed on or before the following Milestone(s). Milestones 2 through 5 do not need to be completed in sequential order.

- Milestone 1: 90 days for Equipment and Materials Submittals Approval from Notice to Proceed. This should include all equipment and materials that will take more than 6 weeks to be delivered.
- Milestone 2: 100 days for substantial completion of South Welches PS once on-site work begins. Work must be completed no later than March 1st, 2028.
- Milestone 3: 100 days for substantial completion of Golf Club Terrace PS once on-site work begins. Work must be completed no later than March 1st, 2028
- Milestone 4: 90 days for substantial completion of 82nd Ave PS once on-site work begins.
- Milestone 5: 100 days for substantial completion of Sieben Lane PS once on-site work begins. Work must be completed no later than March 1st, 2027.

Time is of the essence for this Project. Note the Liquidated Damages requirements as described in the Supplemental General Conditions.

The Scope further includes the following Plans, Specifications and Drawings:

- Technical Specifications- Pump Station Rehabilitation and Upgrades Project- Group 3 Volume 1 of 3 (361 pages)
- Technical Specifications- Pump Station Rehabilitation and Upgrades Project- Group 3 Volume 2 of 3 (534 pages)
- Drawing Set Pump Station Rehabilitation and Upgrades Project- Group 3 Volume 3 of 3 (184 pages)

EXHIBIT D

SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract as indicated below. The General Conditions remain in full force and effect except as amended or supplemented.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof. As used in the Contract Documents, masculine pronouns refer to both masculine and feminine genders.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added.

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

SC-1.01 Delete and replace the following subsections in Paragraph 1.01.A:

5. *Bidder*: Any individual, partnership, corporation, joint venture, or other legal entity who submits a Bid to Owner for the Work contemplated and meets the standards set forth in Oregon Revised Statutes 279B.110.

16. *Contractor*: Person or entity identified as such in the Agreement and the Contractor's authorized representatives who are referred to throughout the Contract Documents as if singular in number.

22. *Engineer*: Person or entity identified as such in the Agreement and the Engineer's authorized representatives who are referred to throughout the Contract Documents as if singular in number.

30. *Owner*: The individual, entity, public body or authority identified as such in the Agreement and the Owner's authorized representatives who are referred to throughout the Contract Documents as if singular in number.

SC-1.01 Revise Paragraph 1.01.A.33 by replacing the word "Engineer" with "Owner" and adding the sentence "Synonymous with Construction Manager." to the end of the paragraph.

SC-1.01 Add the following language at the end of 1.01.A.42:

Substantial Completion is further defined as (i) that degree of completion of the Project's operating facilities or systems sufficient to provide Owner the full time, uninterrupted, and continuous beneficial operation of the Work; (ii) all required functional, performance, and acceptance or startup testing has been successfully demonstrated for all components, devices, equipment, and instrumentation and control to the satisfaction of Engineer in accordance with the requirements of the Specifications; (iii) all inspections required have been completed and identified critical defective Work has been replaced or corrected; and (iv) all appurtenant operations and maintenance features (i.e., hose bibs, drainage systems,

etc.) have been installed and are functional. See Paragraph SC-15.03.A for additional requirements.

SC-1.01 Add the following language to the end of the sentence in Paragraph 1.01.A.44:

"as further identified in the Agreement."

SC-1.01 Add new paragraphs immediately following Paragraph 1.01.A.50:

51. *Latent Defect*: A defect in the Work of which the Owner has no knowledge.

52. *Specialist*: The term Specialist refers to a person, partnership, firm, or corporation of established reputation (or if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing of fabricated items required by the Contract Documents, or otherwise performing Work required by the Contract Documents. Where the Specifications require the installation by a Specialist, that term shall also be deemed to mean either the manufacturer of the items, a person, partnership, firm, or corporation licensed by the manufacturer, or a person, partnership, firm, or corporation who will perform the Work under the manufacturer's direct supervision.

53. *Construction Manager*: Person or entity designated by the Owner to provide construction management services for the Project with duties, responsibilities, and limitations of the Engineer, unless stipulated otherwise. Synonymous with and having same meaning as Resident Project Representative.

54. *Equipment*:

    a) Construction: All machinery and equipment, together with the necessary supplies for upkeep and maintenance, including tools and apparatus necessary for the proper construction and acceptable completion of the Work contemplated.

    b) Installation: All material or articles used in equipping a facility or apparatus required to fulfill a functional design.

55. *Geotechnical Data Report ("GDR")*: The factual report that collects and presents data regarding actual subsurface conditions at or adjacent to the Site, including Technical Data and other geotechnical data, prepared by or for Owner. The GDR's content may include logs of borings, trenches, and other site investigations, recorded measurements of subsurface water levels, the results of field and laboratory testing, and descriptions of the investigative and testing programs. The GDR does not include an interpretation of the data. If opinions, or interpretive or speculative non-factual comments or statements appear in a document that is labeled a GDR, such opinions,

comments, or statements are not operative parts of the GDR and do not have contractual standing. Subject to that exception, the GDR is a Contract Document.

56. ORS: Oregon Revised Statutes.

57. OAR: Oregon Administrative Rules.

58. Float: The number of days an activity can be delayed beyond its scheduled completion without delaying a succeeding or related activity or restricting the schedule of a preceding activity in the construction schedule.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

SC-2.01 Delete Paragraphs 2.01.B. and C. in their entirety and insert the following in their place:

B. *Evidence of Contractor's Insurance:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies (including all endorsements, and identification of applicable self-insured retentions and deductibles) of insurance required to be provided by Contractor in this Contract. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

C. *Public Works Bond:* Before starting any work on the Project, Contractor and every Subcontractor performing work on the Project must have a public works bond filed with the Oregon Construction Contractors Board, as required by ORS 279C.830 and 279C.836, unless exempt under those provisions. Contractor must require that the Subcontractor have a public works bond filed with the Construction Contractors Board before starting work on the Project unless exempt under ORS 279C.836. Contractor shall include copies of both its public works bond and the public works bonds from its Subcontractors in the copies of the bonds required in Paragraph 2.01.A above. See SC-6.01.A for additional requirements related to the public works bond.

2.02 *Copies of Documents*

SC-2.02 Delete the first sentence of Paragraph 2.02.A in its entirety and replace with the following:

If requested, Owner shall furnish to Contractor up to four copies of the conformed Contract Documents (Specifications and half size Drawings and two copies of full-size Drawings) incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully executed counterpart of the Agreement) and one copy in electronic portable document format (PDF).

2.03 *Before Starting Construction*

SC-2.03 Add new paragraph immediately following Paragraph 2.03.A.3:

4. a preliminary schedule of payments showing projected cash flow.

SC-2.03 Add new paragraphs immediately following Paragraph 2.03.A:

B. Before any Work at the Site is started, Contractor shall prepare and submit a written plan for the Project-specific safety precautions and programs. The safety plan shall identify Contractor's process for ensuring that safety is the highest priority on the Project and will be

complete with respect to procedures and actions that Contractor intends for Contractor and all others as provided in Paragraphs 7.13 and as required by all applicable Laws and Regulations. The submittal shall include a statement that the Contractor is solely responsible for safety on the Project, that it will conduct its operations in accordance with all applicable safety standards and requirements, and that it will continually review its operations to ensure that safe conditions are provided at all times. Contractor's plan for safety precautions and programs shall have been approved and endorsed by Contractor's designated safety representative required in Paragraph 7.13.B. Delivery of this plan will in no way reduce or obviate Contractor's obligation to comply with the safety obligations set forth in Section 7.13 of the General Conditions.

C. *Contractor Drug Testing Program*: Before any Work at the site is started, Contractor shall provide evidence that it has an employee drug testing program in place that is administered and enforced by the Contractor in accordance with ORS 279C.505.

D. Before any Work at the Site is started, Contractor shall prepare and submit a plan describing their Workplace Harassment Prevention Program. The program shall ensure all workers, regardless of their identity or status, are guaranteed a safe and respectful work environment. This applies, but is not limited to, a worker's race, ethnicity, color, national origin, gender identity, gender expression, sex, sexual orientation, religion, marital or familial status, age, mental or physical disability (as defined by the American's with Disabilities Act and Oregon state law), former incarceration, immigrant status, or veteran status.

   1. The program shall include in-person/virtual training for workers of all ranks and meaningful policies including procedures for aggrieved workers in need of recourse.

   2. Contractor shall post on the jobsite and make available a notice that rights of workers on the site include:

      a. Participation in positive jobsite training.

      b. Copies of policies about hate, intimidation or harassment including how to report and how to receive support. Contractor must provide these materials in languages inclusive of the workforce.

      c. Contractor shall investigate incidents involving bullying or harassment in a prompt, thorough, and impartial manner.

E. Contractor shall assume responsibility for every aspect of providing a safe and respectful workplace on the jobsite, including a safe and respectful workplace for and by Subcontractors, suppliers and other persons on the jobsite.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

SC-2.04 Add the following to the end of Paragraph 2.04.A:

The preconstruction conference will be scheduled by Contractor within five (5) days of the Notice to Proceed or as otherwise agreed to by the parties.

2.05 *Acceptance of Schedules*

SC-2.05 Add the following to the end of Paragraph 2.05.A:

5. Contractor's schedule of payments will be acceptable if it provides a reasonable projection of payments in relationship to the Progress Schedule and Schedule of Values.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

SC 3.01 Add the following to the end of Paragraph 3.01.A:

However, in the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following descending order of precedence:

1. Permits from outside agencies;
2. The Agreement including exhibits, and addenda and any amendments thereto, with those of later date having precedence over those of an earlier date;
3. Supplementary General Conditions;
4. Standard General Conditions of the Construction Contract, Engineers Joint Contract Documents Committee (EJCDC) 2018;
5. Specifications – Division 01;
6. Specifications – Divisions 02 - 49;
7. Drawings;
8. Design Details: Figure dimensions, and dimensions that can be computed, on plans shall take precedence over scale dimensions. The Drawings with the higher level of detail take precedence over less detailed Drawings.

Change Orders, Work Change Directives, Field Orders, Engineer's written interpretation and clarifications and Notice to Proceed, in precedence listed, will take precedence over all other Contract Document components referenced herein.

SC 3.01 Add the following paragraph immediately after Paragraph 3.01.G:

H. Sections of Division 01, General Requirements, govern the execution of the Work of all sections of the Specifications.

3.03 *Reporting and Resolving Discrepancies*

SC 3.03 Delete Paragraph 3.03.B.1 in its entirety and replace with the following:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and the provision of any standard specification, manual, reference standard, or code,

or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document).

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

SC 4.01 Delete the third sentence of Paragraph 4.01.A in its entirety.

4.04 *Progress Schedule*

SC 4.04 Add the following subparagraph immediately after Paragraph 4.04.A.2:

3. If, in the opinion of Engineer, Contractor falls behind the accepted Construction Schedule due to actions or neglect of Contractor or Contractor's agents, servants, employees, officers, Subcontractors, directors, or any party contracting to perform part or all of the Work or to supply any equipment or materials, Contractor shall take steps, including, but not limited to, increasing the number of personnel, shifts, and/or overtime operations, days of work, and/or amount of construction equipment until such time as the Work is back on schedule. Contractor shall also submit for review no later than the time of submittal of the next request for partial payment, such supplementary schedule or schedules as may be necessary to demonstrate the manner in which the acceptable rate of progress will be regained, all without additional cost to Owner.

ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

SC 5.01 Delete Paragraph 5.01.B in its entirety.

SC 5.01 Add the following paragraph immediately after Paragraph 5.01.c:

D. Any work performed in public rights-of-way, in addition to conforming to the Contract Documents, shall be done in accordance with the requirements of the permit issued by the public agency in whose right-of-way the Work is located.

5.02 *Use of Site and Other Areas*

SC 5.02 Delete subparagraph 5.02.A.2 in its entirety and replace with the following:

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claims as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify Owner, Clackamas County and their officers, elected officials, directors, employees, agents, consultants, and subcontractors from and against any such claim, and against all costs, losses and damages arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against

Owner or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
None known to Owner		

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
South Welches Pump Station Record Drawings	7/1981	As builts
Golf Club Terrace Pump Station Record Drawings	1/1987	As builts
82nd Drive Pump Station Record Drawings	3/1978	As builts
Sieben Lane Pump Station Record Drawings	7/1993	As builts

G. Contractor may request copies from Engineer of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
None known to Owner		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
None known to Owner		

SC-5.06 Delete Paragraph 5.06.I and 506.J in their entirety and replace with the following:

I. Subject to the limitations of the Oregon Constitution and the Oregon Tort Claims Act, Owner shall indemnify Contractor, and its officers, employees, and agents from and against all

claims, costs losses and damages arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work; and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify Owner and Clackamas County and their officers, elected officials, directors, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.C:

The Contractor will submit the performance bond and payment bond on forms provided by the Owner.

SC-6.01 Delete Paragraph 6.01.B in its entirety and replace with the following:

B. Before starting any work on the Project, the Contractor shall file with the Oregon Construction Contractors Board, and maintain in full force and effect, the separate public works bond required by Oregon Revised Statutes, Chapter 279C.830 and 279C.836, unless otherwise exempt under those provisions. The Contractor shall also include in every subcontract a provision requiring the Subcontractor to have a public works bond filed with the Construction Contractors Board before starting Work, unless otherwise exempt, and shall verify that the Subcontractor has filed a public works bond before permitting any Subcontractor to start Work. Contractor shall include copies of both its public works bond

and the public works bonds from its Subcontractors in the copies of the bonds required in Paragraph 2.01.A above.

These bonds shall remain in effect until one year after date of final completion of the Project and acceptance by the Owner, except as provided otherwise by Laws or Regulations or by the Contract Documents.

SC-6.01 Add the following phrase to Paragraph 6.01.C after the word "Treasury":

or otherwise acceptable to Owner.

SC-6.01 Add the following sentence to the end of Paragraph 6.01.C:

The performance bond shall include, in part, provisions to indemnify Owner, and its officers, directors, elected officials, agents, and employees.

6.02 *Insurance—General Provisions*

SC-6.02 Delete paragraph 6.02.B. in its entirety and replace with the following:

B. As evidence of the insurance coverage required by the Contract, the Contractor shall furnish certificate(s) of insurance to the Owner prior to execution of the Agreement. The certificate(s) will specify all of the parties who are additional insureds or loss payees for the Agreement, identified in SC-6.02.C. A renewal certificate shall be sent to Owner at least 10 days prior to coverage expiration.

Insurance coverage required under the Agreement shall be obtained from insurance companies or entities acceptable to the Owner and that are eligible to provide such insurance under Oregon law. Eligible insurers include admitted insurers that have been issued a certificate of authority from the Oregon Department of Consumer and Business Services authorizing them to conduct an insurance business and issue policies of insurance in the state of Oregon, and certain non-admitted surplus lines insurers that satisfy the requirements of applicable Oregon law and which are subject to approval by the Owner. All companies that provide policies required under this Contract shall have a rating of not less than A-X in the most current edition of Best's Rating Guide, in addition to any other requirements specified herein. The Contractor shall be financially responsible for all deductibles, self-insured retentions and/or self-insurance included hereunder. Any deductible, self-insured retention and/or self-insurance in excess of $50,000 shall be subject to approval by the Owner in writing and shall be a condition precedent to the effectiveness of any Contract.

SC-6.02 Add the following to the end of Paragraph 6.02.D:

The general liability insurance coverage, automobile liability, umbrella, and pollution liability if required, shall include the Owner (Water Environment Services), Clackamas County and Engineer (Consor, Inc.) as additional insureds, but only with respect to the Contractor's activities to be performed under the Contract Documents. <u>The additional-insured endorsement for CGL insurance must be written on ISO Form CG 20 10 (10 01) and CG 20 37 (10 01), or their equivalent, but shall not use either of the following forms: CG 20 10 (10 93) or CG 20 10 (03 94). Proof of insurance must include a copy of the</u>

endorsement showing "Water Environment Services and Clackamas County, together with their elected officials, agents, officers, and employees" as scheduled insureds.

If Contractor cannot obtain an insurer to name the Owner and Engineer as additional insureds, Contractor shall obtain at Contractor's expense, and keep in effect during the term of the Contract, Owners and Contractors Protective Liability Insurance, naming the Owner and Engineer as additional insureds with not less than a $4,000,000 limit per occurrence. This policy must be kept in effect for 36 months following final completion. As evidence of coverage, Contractor shall furnish the actual policy to Owner prior to execution of the Agreement.

SC-6.02 Delete all language in Paragraphs 6.02.E, I, and K and replace each with the word "Reserved."

SC-6.02 Delete from Paragraph 6.02.N "10 days" and replace with "60 days"

SC-6.02 Add the following new paragraphs in order after Paragraph 6.02.N.

O. Compliance. Failure of the Contractor to fully comply with these requirements will be considered a material breach of Contract and shall be cause for immediate termination of the Contract at the option of Owner.

P. If the Contractor receives a non-renewal or cancellation notice from an insurance carrier affording coverage required herein, or receives notice that coverage no longer complies with the insurance requirements herein, Contractor agrees to notify Owner within five (5) business days with a copy of the non-renewal or cancellation notice, or written specifics as to which coverage is no longer in compliance. When notified by Owner, the Contractor agrees to stop Work pursuant to the Contract at Contractor's expense, unless all required insurance remain in effect. Any failure to comply with the reporting provisions of this section, except for the potential exhaustion of aggregate limits, shall not affect the coverages provided to the Owner and its institutions, divisions, officers, and employees. Owner shall have the right, but not the obligation, of prohibiting Contractor from entering the Project Site until a new certificate(s) of insurance is provided to Owner evidencing the replacement coverage. The Contractor agrees that Owner reserves the right to withhold payment to Contractor until evidence of reinstated or replacement coverage is provided to Owner.

Q. Upon Owner's approval, Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

R. All insurance carried by Contractor under the Agreement shall be the primary coverage. The coverages indicated are minimums unless otherwise specified in the Contract Documents.

6.03 *Contractor's Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess,

pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: None.

E. *Workers' Compensation and Employer's Liability:* The Contractor is an independent contractor for purposes of the Oregon Workers' Compensation Law, as set forth in ORS Chapter 656 ("Workers' Comp Law") and is solely liable for any Workers' Compensation coverage under this Agreement. All employers, including Contractor, that employ subject workers who work under the Agreement in the State of Oregon shall comply with ORS 656.017 and provide the required Workers' Compensation coverage, unless such employers are exempt under ORS 656.126. This shall include Employer's Liability Insurance with coverage limits of not less than $500,000 per accident for bodily injury or disease. Contractor shall ensure that each of its Subcontractors complies with these requirements. The Contractor shall require proof of such Workers' Compensation coverage by receiving and keeping on file a certificate of insurance from each Subcontractor or anyone else directly employed by either the Contractor or its Subcontractors. The Contractor will be solely responsible for payment of any local, state or federal taxes required as a result of these Contract Documents.

Workers' Compensation and Related Policies	**Policy limits of not less than:**
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Employer's Liability	
Each accident	$500,000

These Contract Documents are not intended to entitle the Contractor to any benefits generally granted to the District, officers, commissioners, agents or employees. Without limitation, but by way of illustration, the benefits not intended to be extended to the Contractor are vacation, holiday and sick leave, other leaves with pay, tenure, medical and dental coverage, life and disability insurance, overtime pay, Social Security, workers' compensation, unemployment compensation, or retirement benefits (except so far as benefits are required by law if the Contractor is presently a member of the Public Employees Retirement System).

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial

general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.
3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$ 2,000,000

Commercial General Liability	Policy limits of not less than:
Products—Completed Operations Aggregate	$ 2,000,000
Personal and Advertising Injury	$ 1,000,000
Bodily Injury and Property Damage—Each Occurrence	$ 1,000,000

J. *Automobile Liability:* Contractor shall obtain, at Contractor's expense, and keep in effect during the term of the Agreement, Automobile Liability Insurance covering owned, and/or hired vehicles, as applicable. The coverage may be written in combination with the Commercial General Liability Insurance. Contractor and its Subcontractors shall be responsible for ensuring that all non-owned vehicles maintain adequate Automobile Liability insurance while on Project Site. The Owner may adjust the Automobile Liability insurance amounts required under this provision at any time based upon institution specific risk assessments through the issuance of an amendment to the Agreement.

Automobile Liability	Policy limits of not less than:
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$ 1,000,000

K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$ 1,000,000
General Aggregate	$ 2,000,000

L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $3,000,000 after accounting for partial attribution of its limits to underlying policies, as allowed above.

M. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$ 1,000,000

Contractor's Pollution Liability	Policy limits of not less than:
General Aggregate	$ 2,000,000

N. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$ 1,000,000
Annual Aggregate	$ 2,000,000

6.05 *Property Losses; Subrogation*

SC-6.05 Delete all language in Paragraphs 6.05.B and C and replace each with the word "Reserved."

6.06 *Receipt and Application of Property Insurance Proceeds*

SC-6.06 Delete Paragraph 6.06.A, B and C in their entirety and replace with the following paragraph:

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.02 *Supervision and Superintendence*

SC-7.02 Add the following immediately after the first sentence of Paragraph 7.02.B:

If a replacement is necessary, the replacement shall also be a competent resident superintendent and shall be subject to prior approval by Owner. The Contractor's superintendent shall be present at the Site at all times while Work is in progress and shall be available by phone for emergencies 24 hours per day, 7 days per week. If at any time the superintendent leaves the Project Site while Work is in progress, Owner and Engineer shall be notified and provided with the name of the Contractor's representative having responsible charge. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be between 7:00 a.m. and 6:00 p.m. on weekdays, Monday through Friday, only. If change to these standard hours is desired, a written request must be placed with Owner and Engineer a minimum of five work days prior to the first day of altered hours.

2. Owner's legal holidays are:

    - New Year's Day (January 1)
    - Martin Luther King Jr. Day (third Monday in January)
    - President's Day (third Monday in February)
    - Memorial Day (last Monday in May)
    - Juneteenth National Independence Day (June 19)
    - Independence Day (July 4)
    - Labor Day (first Monday in September)
    - Veteran's Day (November 11)
    - Thanksgiving Day (fourth Thursday in November)
    - Christmas Day (December 25)

7.04 *Services, Materials, and Equipment*

SC-7.04 Add the following paragraphs immediately after Paragraph 7.04.C:

D. Until Substantial Completion of the Work is acknowledged by Owner, Contractor shall have the responsible charge and care of the Work and of materials to be used herein, including materials for which Contractor has received partial payment or materials which have been furnished by Owner, and shall bear the risk of injury, loss, or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution of the Work or not.

E. Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the Work or the materials occasioned by any cause before the Work's completion and acceptance and shall bear the expense thereof. Where necessary to protect the Work or materials from damage, Contractor shall, at Contractor's own expense, provide suitable drainage and erect such temporary structures or rent such structures as are necessary to protect the Work or materials from damage. The suspension of the Work or the granting of an extension of time for any cause whatever shall not relieve Contractor of Contractor's responsibility for the Work and materials as specified herein.

F. When the quality of a material, process, or article is not specifically set forth in the Contract Documents, the best available quality of the material, process, or article shall be provided.

7.06 *Substitutes*

SC-7.06 Amend Paragraph 7.06.B by deleting the third sentence stating "Engineer will be the sole judge of acceptability."

7.07 *Concerning Subcontractors and Suppliers*

SC-7.07 Add the following language directly following the last sentence of Paragraph 7.06.A:

Contractor shall perform with Contractor's own organization Work amounting to not less than 25 percent of the combined value of all items of the Work covered by the Contract.

SC-7.07 Add the following new paragraphs immediately after Paragraph 7.07.M:

N. Contractor shall ensure that any person entering into any subcontract to perform under the Contract is registered with the Secretary of State to do business in the State of Oregon, not prohibited from entering into a public contract by the Oregon Bureau of Labor and Industry, the Oregon Construction Contractors Board or Federal Excluded Party listings and is a Responsible Proposer as defined by ORS 279C.

O. Subcontractor Insurance: Unless a special type of insurance or special amount of coverage is required by the Owner for a specific subcontract or type of work, Contractor shall require all Subcontractors to provide and maintain insurance coverages with at least $1,000,000/claim, $2,000,000 aggregate for commercial general liability, $500,000/claim for automobile liability, $1,000,000/claim for professional liability (if applicable), and statutory limits for workers' compensation insurance. Contractor shall require certificates of insurance from all Subcontractors as evidence of coverage. Contractor shall provide copies of Subcontractor's certificates of insurance, if requested by Owner. This condition may be met through utilization of a Contractor Controlled Insurance Program.

7.08 *Patent Fees and Royalties*

SC-7.08 Delete Paragraph 7.08.B and .C in their entirety and replace with the following:

B. Subject to the limits of the Oregon Constitution, Owner shall indemnify Contractor, and its officers, employees, agents from and against all claims, costs, losses, and damages arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify Owner, Clackamas County and their officers, directors, elected officials, employees, agents, consultants and subcontractors of from and against all claims, costs, losses, and damages arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

SC-7.09 Add the following new paragraph immediately after Paragraph 7.09.A:

B. Contractor will be responsible for obtaining all required permits and maintaining compliance with those permits throughout the course of the Work. Owner will pay the cost of obtaining all permits. The Contractor shall be responsible for any penalties or fines that result from Contractor's noncompliance with the terms of the permits.

7.11 *Laws and Regulations*

SC-7.11 Delete Paragraph 7.11.B in its entirety and replace with the following:

B. If Contractor performs any Work or takes any other action knowing or having reason to know that is contrary to Laws and Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify Owner, Clackamas County, and their officers, directors, elected officials, employees, agents, consultants and subcontractors from and against all claims, costs, losses and damages arising out of or relating to such Work or other action. It is not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

SC-7.11 Add the following new paragraph immediately after Paragraph 7.11.C:

D. While not intended to be inclusive of all Laws or Regulations for which Contractor may be responsible under Paragraph 7.10, the following Laws or Regulations, as may be amended from time to time, are included as mandated by statute or for the convenience of Contractor:

1. Prevailing Wage Rates:

   a. Contractor shall comply fully with the provisions of ORS 279C.800 through 279C.870. Pursuant to ORS 279C.830(1)(d), Contractor shall pay workers not less than the specified minimum hourly rate of wage, and shall include that requirements in all subcontracts.
   PREVAILING WAGE RATES for Public Works Contracts in Oregon, July 5, 2025 which can be downloaded at the following web address:
   http://www.oregon.gov/boli/whd/pwr/pages/pwr_state.aspx

   b. Owner will pay the Commissioner of the Bureau of Labor and Industries the fee required by ORS 279C.825.

   c. Contractor shall provide written notice to all workers of the number of hours per day and days per week such workers may be required to work.

2. Discrimination: Contractor shall comply with all applicable requirements of federal and state civil rights and rehabilitation statutes, rules and regulations, and:

   a. In accordance with ORS 279A.110, Contractor will not discriminate against Disadvantaged, Minority, Women, or Emerging Small Business enterprises, as those terms are defined in ORS 200.005, or a business enterprise that is owned or controlled by or that employs a disabled veteran, as that term is defined in ORS 408.225, in obtaining required subcontracts.

   b. Contractor shall maintain, in current and valid form, all licenses and certificates required by the applicable Laws, Regulations or the Contract when performing the work.

3. In accordance with ORS 279C.505, Contractor shall demonstrate to Owner that it has an employee drug testing program is in place prior to commencement and at all times during the performance of the Work.

4. ORS 654.150 applies at the Construction Site. All costs incurred in complying with state statutes requiring sanitation facilities shall be borne by Contractor.

5. Payment by Contractor:

a. The Contractor shall promptly make full payment for labor, materials, supplies and provisions at such times as they become due and payable to all persons supplying the Contractor or their Subcontractor with labor, services, materials, supplies, or provisions for the prosecution of the Work provided for in the Contract. Contractor shall pay all contributions or amounts due the Industrial Accident Fund from such Contractor or Subcontractor incurred in the performance of the Work. The Contractor shall not permit any lien or claim to be filed or prosecuted against the Owner for or on account of any labor, services, materials, supplies, or provisions furnished. The Contractor shall pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167.

b. In the event the Contractor fails, neglects, or refuses to make prompt and full payment of any claim for labor, services, materials, supplies or provisions furnished by any person in connection with the Work, whether the labor, services, materials, supplies, or provisions to be performed are furnished for the Contractor or for a Subcontractor, then and in such event, the Owner may withhold the amount of such claim by the person or persons furnishing such labor, services, materials, supplies, or provisions and deduct the amount of from funds due or to become due to the Contractor by reason of the Contract Documents. The deduction of any such amounts because of claims and the manner herein authorized will not, however, relieve the Contractor or his surety from their obligation with respect to any unpaid claims. Sums withheld for the purposes named herein will be paid to the Contractor upon certification that said claims have been paid. Notwithstanding the foregoing, Owner, in its discretion, may pay such claims and deduct or charge that amount of the payment against funds due or to become due the Contractor by reason of the Contract Documents.

c. If the Contractor or a first-tier Subcontractor fails, neglects or refuses to make payment to a party furnishing labor or materials in connection with the project within 30 days after receipt of payment from the Owner or Contractor, the Contractor or first-tier Subcontractor shall owe the party the amount due plus interest charges commencing at the end of the ten-day period that payment is due under ORS 279C.580(4) and any upon final payment unless payment is subject to a good-faith dispute as defined in ORS 279C.580. The rate of interest charge to the Contractor or first-tier Subcontractor and the amount due shall equal three times the discount rate on 90-day commercial paper in effect at the Federal Reserve Bank in the Federal Reserve District that includes Oregon on the date that is 30 days after the date when payment was received from the Owner or from the Contractor, but the rate of interest shall not exceed 30 percent. The amount of interest may not be waived. Contractor shall incorporate this provision into all subcontracts.

d. If the Contractor or a Subcontractor fails, neglects or refuses to make payment to a person furnishing labor or materials in connection with the Contract, the person may file a complaint with the Oregon Construction Contractor's Board unless payment is subject to a good-faith dispute as defined in ORS 279C.580. Resolution of such dispute and computation of amounts due plus interest and costs shall be as provided in that statute. Contractor shall incorporate this provision into any subcontract related to this project.

e. The payment of a claim in the manner authorized under this section shall not relieve the Contractor or the surety from any obligation with respect to any unpaid claims.

f. Contractor shall pay Subcontractor for satisfactory performance within ten days out of such amounts paid to Contractor by Owner, and shall at all times comply with ORS 279C.580, which is incorporated herein by reference.

g. The Contractor shall include in each subcontract for property or services entered into by the Contractor and a first-tier Subcontractor, including a materials supplier, for the purpose of performing a construction contract, a payment clause that obligates the Contractor to pay the first-tier Subcontractor for satisfactory performance under its subcontract within ten (10) days out of such amounts as are paid to the Contractor by the Owner under such Contractor.

h. All employers, including Contractor, that employ subject workers who work under the Contract Documents in the State of Oregon shall comply with ORS 656.017 and provide the required Workers Compensation coverage, unless such employees are exempt under ORS 656.126. Contractor shall ensure that each of its subcontracts complies with these requirements.

i. As a condition to Owner's performance hereunder, Contractor shall promptly, as due, make payment to any person, co-partnership, association or corporation furnishing medical, surgical, and hospital care or other needed care and attention, incident to sickness or injury, to the employees of the Contractor, of all sums of which the Contractor agrees to pay for the services and all moneys and sums that the Contractor collected or deducted from the wages of employees under any law, contract or agreement for the purpose of providing or paying for the services.

6. Payroll Certification and Fee Requirements.

a. In accordance with ORS 279C.845, the Contractor and every Subcontractor shall submit written certified statements to the Owner on the form prescribed by the Commissioner of BOLI, certifying the hourly rate of wage paid each worker which the Contractor or the Subcontractor has employed on the Project and further certifying that no worker employed on the Project has been paid less than the prevailing rate of wage or less than the minimum hourly rate of wage specified in the Contract Documents, which certified and statement shall be verified by the oath of the Contractor or the Subcontractor that the Contractor or Subcontractor knows the contents of the certified statement, and, that to the Contractor's or Subcontractor's best knowledge and belief, the certified statement is true. The certified statements shall set out accurately and completely the payroll costs for the prior week, including the name and address for each worker, the worker's correct classification, rate of pay, daily and weekly number of hours worked, deductions made, and actual wages paid. Certified statements for each week during which the Contractor or Subcontractor has employed a worker on the Project shall be submitted once a month, by the fifth (5th) business day of the following month. The Contractor and Subcontractor shall preserve the certified statements for a period of ten (10) years from the date of completion of the Work.

b. Pursuant to ORS 279C.845(7), the Owner shall retain 25 percent of any amount earned by the Contractor, in addition to other retainage, on the Work until the Contractor has filed the certified statements required above. The Owner shall pay

the Contractor the amount retained under this subsection within 14 business days after the Contractor files the required certified statements, regardless of whether a Subcontractor has failed to file certified statements.

c. Pursuant to ORS 279C.845(8), the Contractor shall retain 25 percent of any amount earned by a first-tier Subcontractor on this Project until the Subcontractor has filed with the Owner the certified statements required above. Before paying any amount required under this subsection, the Contractor shall verify that the first-tier Subcontractor has filed the certified statement. Within 14 days after the first-tier Subcontractor has filed the certified statement, the Contractor shall pay the first-tier Subcontractor any amount retained under this subsection.

7 Subcontracts. Contractor shall include in each first-tier subcontract, and shall require that each first-tier Subcontractor include in each lower-tier subcontract; clauses for payments, interest penalties and conditions as required under ORS 279C.580, which is incorporated herein by reference. Contractor shall certify that it shall not accept a bid from Subcontractors to perform Work unless such Subcontractors are registered with the Construction Contractors Board in accordance with ORS 701.021 at the time they submit their bids to the Contractor.

8. Environmental Pollution:

a. In compliance with ORS 279C.525, lists of federal, state, and local agencies of which the Owner has knowledge that have enacted ordinances or regulations relating to environmental pollution and the preservation of natural resources that may affect the performance of the Contract are listed in the 2015 Oregon Department of Transportation Standard Specifications for Construction, Section 00170.01.

b. If Contractor is delayed or must undertake additional work by reason of existing regulation or ordinances of agencies not cited herein, or due to enactment of new or the amendment of existing statutes, ordinances or regulations occurring after the submission of the successful Proposal, Owner may grant a time extension, a reasonable adjustment in the Cost of Work by issuance of a Change Order setting forth the additional work that must be undertaken. Such Change Order, if any, shall not invalidate the Agreement and shall, as applicable, increase the Agreement price to compensate Contractor for all costs and expenses incurred, including overhead and profits, as reasonable compensation of any such delay or additional work.

9. In accordance with ORS 279C.510, Contractor shall salvage or recycle construction and demolition debris if feasible and cost effective.

10. Workers employed by Contractor shall not be able to collect for unpaid overtime unless a claim is filed in accordance with ORS 279C.545 with Contractor.

11. Person claiming not being paid in full for supplied labor or materials for performance of the Work has right to file notice of such claim. Notice shall be filed in accordance with ORS 279C.605.

12. As applicable, Contractor shall comply with Clackamas County Code and Water Environment Services Rules and Regulations.

13. Contractor agrees to comply with the following, as applicable and as may be amended from time to time: i) Title VI and VII of the Civil Rights Act of 1964; ii) Section 503 and

504 of the Rehabilitation Act of 1973; iii) the Health Insurance Portability and Accountability Act of 1996; iv) the Americans with Disabilities Act of 1990; v) ORS Chapter 659A; vi) all regulations and administrative rules established pursuant to any applicable laws; and vii) all other applicable requirements of federal, state, county or other local government entity statutes, rules and regulations.

14. The following notice is applicable to Contractors who perform excavation Work: ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0090. You may obtain copies of the rules by calling the center at (877) 668 4001.

15. Independent Contractor Status: The service or services performed under the Contract Documents are those of an independent contractor as defined in ORS 670.600. Contractor represents and warrants that it is not an officer, employee or agent of the Owner as those terms are used in ORS 30.265.

16. Retirement System Status and Taxes: Contractor represents and warrants that it is not a contributing member of the Public Employees' Retirement System and will be responsible for any federal or state taxes applicable to payment received under the Agreement. Contractor will not be eligible for any benefits from these payments under the Agreement of federal Social Security, employment insurance, workers' compensation or the Public Employees' Retirement System, except as a self-employed individual. Unless Contractor is subject to backup withholding, Owner will not withhold from such payments any amount(s) to cover Contractor's federal or state tax obligations.

17. Government Employment Status: The Contractor represents and warrants that it is not currently employed by the Federal Government. This does not preclude the Contractor from holding another contract with the Federal Government.

19. Failure to comply with any or all of the requirements of Section 7.11.D shall be a material breach of the Contract and constitute grounds for Contract termination. Any and all damages or costs resulting from such noncompliance shall be the responsibility of Contractor.

7.12 *Record Documents*

SC-7.12 Amend Paragraph 7.12.A by adding "and Owner" after the word "Engineer" in the third sentence.

7.13 *Safety and Protection*

SC-7.13 Add the following directly after the last sentence of Paragraph 7.13.E:

Contractor shall be aware that permit-required confined spaces exist in or near the Project Site. Entry to these spaces must be accomplished in compliance with the requirements of OAR 166-150-0190 (29 CFR 1910.146). Examples of permit-required confined spaces include but are not limited to the following:

- Open tanks beyond the handrails including clarifiers, aeration basins, channels, etc.
- Manholes.
- Flow control structures which have the potential to contain sewage.

- Enclosed tanks including digesters, clarifiers, grit basins, chemical tanks, etc.
- Wet well and dry wells of pump stations.
- Headworks channels.
- Electrical vaults.

The hazards associated with these confined spaces may include but are not limited to:

- Oxygen deficiency.
- Combustible vapors including methane.
- Slip hazards.
- Fall/retrieval hazard.
- Engulfment hazard.
- Lockout required of mechanical and electrical devices.
- Toxic or hazardous chemicals including hydrogen sulfide and process chemicals.
- Traffic hazards.
- Hot work and ignition sources.
- Potential for rapid changes in working conditions.
- Painting or coating application activities often pose temporary hazards.

Prior to beginning Work in permit-required confined spaces, Contractor shall provide Owner with a copy of Contractor's permit-required confined space entry plan/program including a copy of the permit forms that will be used by Contractor. Upon request by Contractor, Owner will review with Contractor, Owner's permit-required confined space program and specific procedures Owner would incorporate in spaces entered. Owner will coordinate any of its entries into the same spaces with Contractor. When the permit-required confined space Work is completed, Contractor shall inform Owner, in writing, of any hazards encountered or changes made resulting in different hazards within the space.

SC-7.13 Add the following new paragraphs immediately after Paragraph 7.13.J:

K. Contractor shall revise Contractor's plan for safety precautions and programs at appropriate times to reflect changes in construction conditions, the Work, Contractor's means, methods, techniques, sequences, and procedures of construction. Contractor shall disseminate the original plan and revisions to all others indicated in Paragraphs 7.13.C.1.

L. Contractor's plan for safety precautions and programs will not require more stringent safety requirements, training or other qualifications for all others than Contractor sets forth for comparable activity and responsibility of Contractor, Subcontractors and Suppliers and their respective employees.

7.15 *Emergencies*

SC-7.15 Amend Paragraph 7.15.A by adding the words "and Owner" immediately after the word "Engineer" in the second sentence.

7.17 *Contractor's General Warranty and Guarantee*

SC-7.17 Add the following new paragraph after Paragraph 7.17.D.9:

10. any acceptance by Owner or any failure to do so.

SC-7.17 Add the following new paragraph after Paragraph 7.17.E:

F. Contractor shall warrant the Work to be free of defects in materials and workmanship for a period of one year from the date of Substantial Completion by the Owner. The Contractor shall correct defective Work during the warranty period as described in the General Conditions.

7.18 *Indemnification*

SC-7.18 Delete Paragraph 7.18.A in its entirety and replace with the following:

A. Contractor shall be responsible for all damage to property, injury to persons, and loss, expense, inconvenience, and delay that may be caused by, or result from, the carrying out of the Work to be done under the Contract, or from any act, omission or neglect of the Contractor, its Subcontractors, employees, guests, visitors, invitees and agents.

To the fullest extent permitted by law, Contractor shall indemnify and defend (with counsel approved by Owner) the Owner, Clackamas County, and their elected officials, officers, directors, agents, and employees (collectively "Indemnitees") from and against all liabilities, damages, losses, claims, expenses, demands and actions of any nature whatsoever which arise out of, result from or are related to: (a) any damage, injury, loss, expense, inconvenience or delay; (b) any accident or occurrence which happens or is alleged to have happened in or about the Project Site or any place where the Work is being performed, or in the vicinity of either, at any time prior to the time the Work is fully completed in all respects; (c) any failure of the Contractor to observe or perform any duty or obligation under the Contract Documents which is to be observed or performed by the Contractor, or any breach of any agreement, representation or warranty of the Contractor contained in the Contract Documents or in any subcontract; (d) the negligent acts or omissions of the Contractor, a Subcontractor or anyone directly or indirectly employed by them or any one of them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder (except to the extent otherwise void under ORS 30.140); and (e) any lien filed upon the Project or bond claim in connection with the Work. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this section.

In addition, Contractor shall indemnify the Owner, Clackamas County, and their elected officials, officers, directors, agents, and employees from and against any and all actions, claims, fines, costs or damages incurred by Owner as a result of a violation of the Owner's National Pollutant Discharge Elimination System Permit, where such violations are the result of the Contractor's negligence. The Owner may withhold from any payments owed to the Contractor the amount of such fines, and a Change Order shall be issued to reflect any such reduction.

However, neither Contractor nor any attorney engaged by Contractor shall defend the claim in the name of Owner or Clackamas County ("County"), purport to act as legal representative of Owner or County, nor settle any claim on behalf of Owner or County without the prior approval of the Clackamas County Counsel's Office. Owner or County may assume their own defense and settlement at their election and expense.

SC-7.18 Amend paragraph 7.18.B by removing "or Engineer" from the first sentence.

ARTICLE 8—OTHER WORK AT THE SITE

8.02 *Coordination*

SC-8.02 Add the following new Paragraph 8.02.C immediately after Paragraph 8.02.B:

C. Other work anticipated to be performed at the Site by others that is not related to but coincides with the scheduled performance of the Work under these Contract Documents is described in Section 01 31 13, Project Coordination.

8.03 *Legal Relationships*

SC-8.03 Amend Paragraph 8.03.C by deleting both uses of the word "Engineer" from the first sentence.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.02 *Replacement of Engineer*

SC-9.02 Amend Paragraph 9.02.A by deleting the words "provided Contractor makes no reasonable objection to the replacement engineer."

9.05 *Lands and Easements; Reports, Tests, and Drawings*

SC-9.05 Delete Paragraph 9.05.C in its entirety and replace with the following:

D. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site relating to existing surface or subsurface structures at the Site that have been utilized by Engineer in preparing the Contract Documents.

9.11 *Evidence of Financial Arrangements*

SC-9.11 Delete Paragraph 9.11.A in its entirety and replace with the following:

A. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

SC-10.06 Delete the last sentence of Paragraph 10.06.A and replace it with the following:

In rendering such decisions and judgments, Engineer will not show partiality to the Owner or Contractor. If a dispute, matter for interpretation or need for judgment arises that includes allegations against the Engineer, then the Engineer shall not be the party deciding that matter.

10.07 *Limitations on Engineer's Authority and Responsibilities*

SC-10.07 Add the following new paragraph immediately after Paragraph 10.07.E:

F. Only the Owner has the authority to authorize modifications of the Contract Documents, additional Work, or changes the Contract Time or Contract Price.

ARTICLE 11—CHANGES TO THE CONTRACT

11.02 *Change Orders*

SC-11.02 Delete Paragraph 11.02.B in its entirety.

11.07 *Change of Contract Price*

SC-11.07 Amend Paragraph 11.07.C.2.a by replacing "15" with "10".

SC-11.07 Amend Paragraph 11.07.C.2.c by replacing "15" with "10".

SC-11.07 Add the following new paragraph immediately after Paragraph 11.07.C:

E. In the event Contractor submits request for additional compensation as a result of a change or differing Site conditions, or as a result of delays, acceleration, or loss of productivity, Owner reserves right, upon written request, to audit and inspect Contractor's books and records relating to the Project. Upon written request for an audit, Contractor shall make its books and records available within 14 days of request. Owner shall specifically designate the identity of the auditor. As part of audit, Contractor shall make available its books and records relating to the Project, including, but not limited to, Bidding Documents, cost reports, payroll records, material invoices, subcontracts, purchase orders, daily timesheets, and daily diaries. Audit shall be limited to those cost items that are sought by Contractor in a Change Order or Claim submission to Owner.

11.08 *Change of Contract Times*

SC-11.08 Add the following to Paragraph 11.08.B:

All requests for time extensions shall be supported by Schedule analysis showing the effect on the entire Project taking into account concurrent Work and the critical path, including Float. Partial demonstration of impact on particular operations only will not be acceptable to show the criticality of any event on the Project Schedule as a whole.

SC-11.08 Add the following new paragraphs immediately following Paragraph 11.08.B:

C. *Use of Float*:

1. A claim for an adjustment of Contract Times (or Milestones), otherwise allowable under the Contract Documents, shall be granted only when the time lost or gained exceeds the float for the activity at the time of the event giving rise to the claim. Float is jointly owned by both Owner and Contractor, whether expressly disclosed or implied in any manner.

2. Contractor shall not use Float suppression techniques (including, but not limited to, preferential sequencing caused by late starts of follow-up trades, unreasonably small crews, extended durations, or imposed dates) in information provided to Owner or Engineer.

ARTICLE 12—CLAIMS

12.01 *Claims*

SC-12.01 Delete Paragraph 12.01.A.1 in its entirety and replace with the following:

1. Appeals by the Contractor of Owner's decisions regarding Change Proposals;

SC-12.01 Add the following language to the end of the sentence in Paragraph 12.01.D.3:

"for disputes involving the Owner and Contractor."

ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 *Cost of the Work*

SC-13.01 Amend Paragraph 13.01.B.1 by deleting the third sentence and replacing it with the following language:

Labor costs for employees in the direct employ of Contractor in the performance of the Work will be the actual cost for wages in accordance with the Oregon BOLI Prevailing Wage Rates for Public Works Contracts in Oregon (see SC-7.10.D.1.a for specific BOLI publication) for each craft or type of workers performing the Work at the time the Work is done, plus BOLI's established Fringe Rate for employer payments of payroll taxes, worker compensation insurance, liability insurance, health and welfare, pension, vacation, apprenticeship funds, and other direct costs resulting from Federal, State or local laws, as well as assessments or benefits required by lawful collective bargaining agreements. Labor costs for equipment operators and helpers will be paid only when such costs are not included in the invoice for equipment rental. The labor costs for foremen and superintendents shall be proportioned to all of their assigned Work and only that applicable to extra Work shall be paid.

SC-13.01 In Paragraph 13.01.B.4, delete the word "special" and replace with the word "technical," and delete the parenthetical phrase "(including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants)" in its entirety.

SC-13.01 Delete Paragraph 13.01.B.5.c in its entirety and replace with the following:

c. Rentals of construction equipment at the rental rate listed for such equipment specified in the current edition of the "Contractor's Equipment Cost Guide" as published by Equipment Watch (www.equipmentwatch.com), telephone number 800/699-3282, or from rate sheets from local rental companies. Such rental rate will be used to compute payments for equipment whether the equipment is under the Contractor's control through direct ownership, leasing, renting, or another method of acquisition. The rental rate to be applied for use of each item of equipment will be the rate resulting in the least total cost to the Owner for the total period of use. If it is deemed necessary by the Contractor to use the equipment not listed by the references specified herein, an equitable rental rate for the equipment will be established by the Engineer. The Contractor may furnish cost data which might assist the Engineer in the establishment of the rental rate. Payment shall be subject to the following:

1) Payment for equipment which is already on the Project Site and which is used in the completion of Work will not be allowed;

2) All equipment shall, in the opinion of the Engineer, be in good working condition and suitable for the purpose for which the equipment is to be used;

3) Before construction equipment is used on the extra Work, the Contractor shall plainly stencil or stamp an identifying number thereon at a conspicuous location, and shall furnish to the Engineer, in duplicate, a description of the equipment and its identifying number;

4) Unless otherwise specified, manufacturer's ratings and manufacturer approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least minimum rating recommended by the manufacturer;

5) Individual pieces of equipment or tools having a replacement value of $400 or less, whether or not consumed by use, will be considered to be small tools and no payment will be made therefore; and

6) Rental time will not be allowed while equipment is inoperative due to breakdowns.

The rental time to be paid for equipment at the Site will be the time the equipment is in productive operation on the Work being performed and, in addition, will include the time required to move the equipment to the location of the extra Work and return it to the original location or to another location; except, that moving time will not be paid if the equipment is used on other than the Work, even though located at the Site of the Work. Loading and transporting costs will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power, except that no payment will be made for loading and transporting costs when the equipment is used at the Site of the Work on other than the Work related to the Change Order, Change proposal, Claim, set-off, or other adjustment in Contract Price. Rental time will not be allowed while equipment is inoperative due to breakdowns. The rental time of equipment on the Work Site will be computed subject to the following:

1) When hourly rates are listed, any part of an hour less than 30 minutes of operation will be considered to be one-half hour of operation, and any part of an hour in excess of 30 minutes will be considered 1 hour of operation;

2) When daily rates are listed, any part of a day less than 4 hours operation will be considered to be half-day of operation. When Owner -operated equipment is used to perform extra Work to be paid from on time and materials basis, the Contractor will be paid for the equipment and operator, as follows;

a) Payment for the equipment will be made in accordance with the provisions in Paragraph 13.01.B.5.c above;

b) Payment for the cost of labor and subsistence or travel allowance will be made at the rates established in Paragraph SC-13.01.B.1; and

c) The direct cost of equipment rental and labor, computed as provided herein, will be added the allowances for equipment rental and labor as provided in Section 00 72 00, General Conditions, Paragraph 13.01.D.

SC-13.01 Add the following language to the end of Paragraph 13.01.B.5.h:

Express and courier services must be approved prior to use.

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following sentence at the end of the existing language:

For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than $500.

SC-13.01 Amend Paragraph 13.01.E by deleting the word “three” in the third sentence and replacing it with “ten”.

SC-13.01 Add the following to Paragraph 13.01.E:

Supporting data shall include but not be limited to daily submissions of timesheets indicating hours and trades worked, equipment and time equipment was employed, and materials expended. Also see SC-7.11.D.6.

If for any reason, any part of the Work or the Contract shall be subject to litigation, Contractor shall retain all such records until all litigation is resolved and Contractor shall continue to provide Owner and/or its agents with full access to such records until such time as all litigation is complete and all periods for appeal have expired and full and final satisfaction of any judgment, order or decree is recorded and Owner receives a record copy of documentation from Contractor.

13.03 *Unit Price Work*

SC-13.03 Delete Paragraph 13.03.E in its entirety.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK

14.02 *Tests , Inspections, and Approvals*

SC-14.02 Delete Paragraph 14.02.A in its entirety and replace with the following:

A. Contractor shall notify Engineer 48 hours prior to the expected time for operations requiring inspection and laboratory testing services. Contractor shall cooperate with inspection and testing personnel and furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.

SC-14.02 Add the following to the end of Paragraph 14.02.D:

Tests required by Contract Documents to be performed by Contractor that require test certificates be submitted to Owner or Engineer for acceptance shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license or certification is not required, testing laboratories or agencies shall meet the following applicable requirements:

1. “Recommended Requirements for Independent Laboratory Qualification,” published by the American Council of Independent Laboratories.
2. Basic requirements of ASTM E329, “Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction” as applicable.
3. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

Prior to requesting a certificate of Substantial Completion, and allowing occupancy of facilities, Contractor shall provide an inspection by a state industrial safety representative, by an independent safety inspector certified by the state in the construction type being inspected, or a federal or state (OSHA) representative qualified in the construction type

being inspected, to determine that the facilities provided are in compliance with the state and federal safety requirements. Signed copies of the inspection reports shall be submitted to the Engineer for Owner's files. Violations or deficiencies noted therein shall be resolved prior to occupancy of the facilities and before final payment will be made.

14.03 *Defective Work*

SC 14.03 Add the following language to Paragraph 14.07.C:

If the Owner is unable to use set-offs to recover the total amount owed under this provision, then Owner may use any and all available methods for recovering the remaining amounts from Contractor.

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

SC-15.01 Amend paragraph 15.01.A by adding the following after the last sentence:

The Owner will make progress payments in accordance with ORS 279C.570.

SC-15.01 Add the following subparagraphs after Paragraph 15.01.B.4:

5. Stored Material and Equipment: Payments for stored materials and equipment shall be based only upon the actual cost of the materials and equipment to Contractor and shall not include any overhead or profit to Contractor. Partial payments will not be made for undelivered materials or equipment.

6. Schedule and Data: During the progress of the Work, each Application for payment shall be accompanied by Contractors updated schedule of operations, or progress report, with Shop Drawings schedules, procurement schedules, and value of materials on had included in the application and other data specified in Section 01 33 00, Submittal Procedures, or reasonably required by Engineer.

7. Unless otherwise indicated in the Contract Documents, partial payment for Equipment shall be as follows:

    a) 5 percent upon final approval of Shop Drawings by Engineer or Owner.

    b) 55 percent upon delivery of goods.

    c) 35 percent upon start-up and final acceptance by Engineer or Owner in accordance with Paragraph 15.04.

    d) 5 percent upon delivery of operations and maintenance manuals.

8. Total price for mobilization shall not exceed 1.0 percent of the Contract Price. Total price for demobilization shall not be less than 2.0 percent of the Contract Price.

SC-15.01 Amend Paragraph 15.01.E.1 by adding the following at the end:

m. Any funds retained pursuant to SC-7.11.D.6, SC-7.18 and SC-15.03.B.

SC--15.01 Add the following new paragraph immediately after Paragraph 15.01.E:

F. Subcontractor Payments. Contractor shall make payments to Subcontractors in accordance with SC-7.11.D.

15.03 *Substantial Completion*

SC-15.03. Amend Paragraph 15.03.A by adding the following:

Conditions precedent to Substantial Completion of the Work and Engineer's issuance of a Certificate of Substantial Completion shall include:

a. Conformance with all training services requirements and deliverables.

b. Submittal of current record documents to the Owner and Engineer.

c. Submittals have been received and approved or accepted by Engineer including, but not limited to, the following:

i. Approved Shop Drawings;

ii. Electrical testing and wiring diagram;

iii. Equipment data forms;

iv. Manufacturer's certificates of proper installation;

v. Factory test reports;

vi. Commissioning, testing and startup reports;

vii. Final Operations and Maintenance Manuals;

viii. Extra materials (spare parts) (as specified).

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

15.06 *Final Payment*

SC-15.06 Add the following new paragraph immediately after Paragraph 15.06.A.2.e:

f. In accordance with ORS 279A.120, when out of state Contractor is awarded a Contract, Contractor is required to report to the Department of Revenue the Contract Price, terms of payment, length of Contract, and other information as Department of Revenue

may require. Owner will verify Contractor has satisfied this requirement prior to issuing final payment.

15.07 *Waiver of Claims*

SC-15.07 Delete Paragraph 15.07.A in its entirety.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

SC-16.01 Amend Paragraph 16.01.A by adding the following language to the end of the third sentence:

"unless the cause for delay is due to the negligence of Contractor or anyone whom Contractor has the responsibility or right to control."

16.02 *Owner May Terminate for Cause*

SC-16.02. Amend Paragraph 16.02.A by adding the following at the end of the sentence:

"in a manner consistent with ORS 279C.670."

16.04 *Contractor May Stop Work or Terminate*

SC-16.04. Delete Paragraph 16.04 in its entirety.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

17.02 *Litigation*

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

17.02 *Litigation*

A. Any Claim between Owner and Contractor that arises from or relates to the Contract and that is not resolved through the Claims Review Process shall be brought and conducted solely and exclusively within the Circuit Court of Clackamas County for the State of Oregon; provided, however, if a Claim must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this section be construed as a waiver by the County of any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. CONTRACTOR, BY EXECUTION OF THE CONTRACT, HEREBY CONSENTS TO THE IN PERSONAM JURISDICTION OF THE COURTS REFERENCED IN THIS SECTION.

ARTICLE 18—MISCELLANEOUS

18.06 *Survival of Obligations*

SC-18.06. Amend Paragraph 18.06.A by adding the following directly after the last sentence:

All warranty and indemnification provisions of the Contract, and all of Contractor's other obligations under the contract that are not fully performed by the time of final completion

or termination, shall survive final completion, final acceptance, or any termination of the Contract.

18.07 *Controlling Law*

SC-18.07 Delete Paragraph 18.07.A in its entirety and replace with the following:

A. This Contract is governed by the laws of the State of Oregon without giving effect to the conflict of law provisions thereof.

18.11 *General Provisions*

SC-18.11 Add the following after Paragraph 18.10:

18.11 *General Provisions*

A. No Third Party Beneficiaries: Owner and Contractor are the only parties to the Contract and are the only parties entitled to enforce its terms. Nothing in the Contract gives, is intended to give, or shall be construed to give or provide any benefit or right, whether directly, indirectly, or otherwise, to third persons unless such third persons are individually identified by name herein and expressly described as intended beneficiaries of the terms of the Contract.

B. Severability: If any provision of the Contract is declared by a court to be unenforceable, illegal, or in conflict with any law, the validity of the remaining terms and provisions shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular provision held to be invalid.

C. Non-Exclusive Rights and Remedies: Except as otherwise expressly provided herein, the rights and remedies expressly afforded under the provisions of the Contract shall not be deemed exclusive, and shall be in addition to and cumulative with any and all rights and remedies otherwise available at law or in equity. The exercise by either Party of any one or more of such remedies shall not preclude the exercise by it, at the same or different times, of any other remedies for the same default or breach, or for any other default or breach, by the other Party.

D. Debt Limitation: The Contract is expressly subject to the debt limitation of Oregon counties set forth in Article XI, Section 10, of the Oregon Constitution, and is contingent upon funds being appropriated therefore. Any provisions herein which would conflict with law are deemed inoperative to that extent.

E. No Attorney Fees: In the event any arbitration, action or proceeding, including any bankruptcy proceeding, is instituted to enforce any term of this Contract, each party shall be responsible for its own attorneys' fees and expenses.

EXHIBIT E

TECHNICAL SPECIFICATIONS – DIV 01 through DIV 23

PUMP STATION REHABILITATION AND UPGRADES PROJECT

GROUP 3 – SOUTH WELCHES, GOLF CLUB TERRACE, 82ND DRIVE AND SIEBEN LANE PUMP STATIONS

FOR

Clackamas Water Environment Services

Volume 1 of 3

MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

Water Environment Services
150 Beavercreek Rd, Suite 430
Oregon City, OR 97045

PROFESSIONAL OF RECORD CERTIFICATION(S):

 RENEWS 12/31/2025	Signing as the Professional of Record for the divisions and sections listed below: Divisions 11, 23

PROFESSIONAL OF RECORD CERTIFICATION(S):



Signing as the Professional of Record for the divisions and sections listed below:

Sections:
01 41 20; 03 21 00; 03 30 00; 03 60 00; 04 05 17; 04 22 00; 05 12 00; 05 12 13; 05 31 23; 05 40 00; 05 50 00; 06 05 23; 06 10 00; 06 17 53

PROFESSIONAL OF RECORD CERTIFICATION(S):

 **Expires: May 31, 2025**	Signing as the Professional of Record for the divisions and sections listed below: Sections 32 91 13, 32 92 00, 32 93 00

PROFESSIONAL OF RECORD CERTIFICATION(S):

	Signing as the Professional of Record for the divisions and sections listed below: Divisions 02, 10, 22, 31, 33, 43 Sections 01 10 00, 01 12 16, 01 22 20, 01 32 00, 01 33 00, 01 45 00, 01 56 39, 01 57 19.11, 01 60 00, 01 75 16, 03 01 30.71.11, 09 90 00, 32 11 23, 32 12 16, 32 31 13, 40 05 13, 40 05 23.72, 40 05 51, 40 05 51.24, 40 05 61, 40 05 62

PROFESSIONAL OF RECORD CERTIFICATION(S):

	Signing as the Professional of Record for the divisions and sections listed below: Division 07 Sections 07 21 00, 07 25 00, 07 30 12, 07 41 13, 07 42 13, 07 62 00, 07 92 00 Division 08 Sections 08 11 13, 08 71 00 Division 09 Sections 09 91 13, 09 91 23

PROFESSIONAL OF RECORD CERTIFICATION(S):

 EXPIRES: June 30, 2026	Signing as the Professional of Record for the divisions and sections listed below: Divisions 40 Sections 40 91 00, 40 91 07, 40 91 08, 40 91 09, 40 91 12, 40 91 14, 40 91 23, 40 92 00, 40 93 00, 40 95 11

PROFESSIONAL OF RECORD CERTIFICATION(S):

 EXPIRES: 6/30/26	Signing as the Professional of Record for the divisions and sections listed below: Divisions 26

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FOR
CLACKAMAS WES

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SECTION 01 10 00 - SUMMARY OF WORK

PART 1 GENERAL

This Summary of Work supplements and amplifies certain sections of the General Conditions and Supplementary General Conditions. These summary of work specifications and additional technical specifications may contain occasional requirements not pertinent to the project. However, these SPECIFICATIONS shall apply in all particulars insofar as they are applicable to this project.

1.1 APPLICABLE STANDARD SPECIFICATIONS AND PLANS

Not applicable.

1.2 SCOPE OF WORK

The WORK to be performed under these SPECIFICATIONS and DRAWINGS consists of WORK to four separate pump stations:

A. Schedule A: South Welches Pump Station

1. The WORK to be performed under these SPECIFICATIONS and DRAWINGS consists of establishing erosion and sediment control, establishment of tree protection, establishment of temporary golf ball netting, establishment of temporary construction fencing, demolition of the existing building roof, demolition of the existing wet well top slab, demolition of the existing pumps, discharge piping, level sensors and valve vault, demolition of a section of the existing force main, tree removal, demolition of existing golf cart path, establishment of temporary bypass, installation of new building roof, with new HVAC, electrical and controls equipment, installation of a new wet well top slab with hatch, new pumps, new discharge piping, new level sensors, new concrete fillets in wet well bottom, new precast bypass vault with permanent bypass port, new precast valve vault, new drain pipe between new valve vault and existing wet well, new yard hydrant, new connection to existing force main, new disconnect panel and cable trench between new building and existing wet well, new generator with concrete base, new asphalt pavement, new aggregate site surfacing, new bollards and new paving to replace demoed golf cart path.

B. Schedule B: Golf Club Terrace Pump Station

1. The WORK to be performed under these SPECIFICATIONS and DRAWINGS consists of establishing erosion and sediment control, demolition of existing wet well top slab, demolition of existing valve vault, demolition of existing cable box adjacent to wet well, demolition of existing building, demolition of existing fence and gate, demolition of existing overhead power, tree removal, establishment of temporary bypass, installation of new building with new water service, HVAC, electrical and controls equipment, new aggregate site surfacing, installation of new wet well top slab with hatch, new pumps, new discharge piping, new level sensors, new precast valve vault with air release valve, new precast bypass vault with permanent bypass port, new disconnect panel and cable trench adjacent to wet well, new generator with concrete base, new fence gates, new bollards, replacement fencing and utility gate and new connection to existing force main.

C. Schedule C: 82nd Drive Pump Station

1. The WORK to be performed under these SPECIFICATIONS and DRAWINGS consists of establishing erosion and sediment control, demolition of the existing wet well fiberglass enclosure, demolition of pumps, discharge piping and connection to existing force main, demolition of the existing above ground control and power panels, tree removal, relocation of existing antenna pole, establishment of temporary bypass, new wet well top risers and slab with hatch, new pumps, discharge piping, new precast valve vault, new precast bypass vault with permanent bypass, new drain pipe between valve vault and wet well, new disconnect panel and cable trench adjacent to wet well, new power and control panels, new aggregate site surfacing, brush clearing, installation of new generator with concrete base, establishing a fenced perimeter around the site with a large utility gate and man gate, repositioning of the existing antenna pole, and new connection to existing force main.

D. Schedule D: Sieben Lane Pump Station

1. The WORK to be performed under these SPECIFICATIONS and DRAWINGS consists of establishing erosion and sediment control, establishing a bypass of the pump station, demolition of existing electrical equipment including the generator, demolition of the existing pumps and discharge piping and appurtenances, installation of new electrical equipment including generator and fuel tank, installation of new submersible level controls, installation of new pumps and discharge piping and appurtenances, demolition of existing HVAC system, installation of new HVAC system, demolition of existing wet well and vault top slab, installation of new wet well and vault top slab and hatches, new water service line including RPBA and meter relocation, replacement of light on existing antenna pole and repaving site.

E. The above general outline of principal features of the WORK does not in any way limit the responsibility of the CONTRACTOR(s) to perform all WORK and furnish all equipment, labor and materials required by the SPECIFICATIONS and DRAWINGS. The DRAWINGS and SPECIFICATIONS shall be considered and used together. Anything appearing as a requirement of either shall be accepted as applicable to both even though not so stated therein or shown.

F. No attempt has been made in these SPECIFICATIONS or DRAWINGS to segregate WORK covered by any trade or subcontract under one specification. Such segregation and establishment of subcontract limits will be solely a matter of specific agreement between the CONTRACTOR and its SUBCONTRACTORs and shall not be based upon any inclusion, segregation, or arrangement in or of these SPECIFICATIONS.

1.3 COORDINATION OF DRAWINGS AND SPECIFICATIONS

A. See Supplementary Conditions Section 3.01 for the Order of Precedence of the Contract Documents.

B. Dimensions shown on the DRAWINGS or that can be computed shall take precedence over scaled dimensions. Notes on DRAWINGS are part of the DRAWINGS and govern in the order described above. Notes on DRAWINGS shall take precedence over drawing details.

C. The intent of the DRAWINGS and SPECIFICATIONS is to prescribe the details for the construction and completion of the WORK which the CONTRACTOR undertakes to perform according to the terms of the Contract. Where the DRAWINGS or SPECIFICATIONS describe

portions of the WORK in general terms, but details are incomplete or silent, it is understood that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Unless otherwise specified, the CONTRACTOR shall furnish all labor, materials, tools, equipment, and incidentals, and do all the WORK involved in executing the Contract in a manner satisfactory to the ENGINEER.

D. The contract DRAWINGS are designated by general title, sheet number and sheet title. When reference is made to the DRAWINGS, the "Sheet Number" of the drawing will be used. Each drawing bears the general title:

PUMP STATION REHABILITATION AND UPGRADES PROJECT
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

The specific titles of each sheet are contained in the DRAWINGS.

1.4 CODE REQUIREMENTS

All WORK shall be done in strict compliance with the requirements of:

A. Oregon Structural Specialty Code and International Building Code
B. Oregon Mechanical Specialty Code
C. Oregon Plumbing Specialty Code
D. National Electric Code
E. National Electric Safety Code
F. National Fire Protection Association
G. Oregon State Bureau of Labor and Industries
H. Clackamas Water Environment Services
I. Oregon Department of Environmental Quality
J. Clackamas County Building Codes

In case of disagreement between codes or these SPECIFICATIONS, the more restrictive shall prevail.

1.5 TIME OF COMPLETION/LIQUIDATED DAMAGES

The CONTRACTOR shall complete all WORK shown and specified within the time limits stated in the Agreement. See Section 01 33 00, Submittal Procedures, for project schedule submittal requirements. The written Notice to Proceed will be sent to the CONTRACTOR after the CONTRACTOR submits the signed Contract, Bonds and insurance certificates to the OWNER and those documents have been approved as to form and executed by the OWNER. The CONTRACTOR's attention is directed to Article 4 of the Agreement and the General Conditions with respect to liquidated damages.

1.6 ACCESS TO WORK

Access to the WORK shall be provided as may be required by the OWNER or its representatives, and all authorized representatives of the state and federal governments and any other agencies having jurisdiction over any phase of the WORK, for inspection of the progress of the WORK, the methods of construction or any other required purposes.

1.7 PERMITS AND LICENSES

See Supplemental Conditions Section 7.09.

1.8 CONSTRUCTION WITHIN PUBLIC RIGHTS-OF-WAY

When the WORK contemplated is wholly or partly within the right-of-way (ROW) of a public agency such as a city, county or state, the CONTRACTOR will obtain from these agencies any right-of-way and street opening permits and all other necessary permit(s) required for the WORK. The CONTRACTOR shall abide by all regulations and conditions stipulated in the permit(s). Such conditions and requirements are hereby made a part of these SPECIFICATIONS, as fully and completely as though the same were fully set forth herein. The CONTRACTOR shall examine the permit(s) granted to the OWNER by any city, county, state and federal agencies. Failure to do so will not relieve the CONTRACTOR from compliance with the requirements stated therein.

The OWNER shall obtain all construction and trade permits and pay all fees or charges related to them. The CONTRACTOR shall furnish any bonds and insurance coverages as necessary to ensure that all requirements of the city, county, state or federal agencies will be observed and the roadway and ditches are restored to their original condition or one equally satisfactory. A copy of all permits shall be kept on the WORK site for use of the ENGINEER.

The following is a list of permits for construction within public rights-of-way:

- Schedule B: Clackamas County ROW permit
- Schedule C: Oregon Department of Transportation (ODOT) ROW permit
- Schedule D: Clackamas County ROW permit

1.9 RAILROAD CROSSINGS

No WORK is allowed to cross the railroad.

1.10 PRIVATE ROADS AND DRIVEWAYS

Bridges at entrances to business properties where vehicular traffic is necessary shall be provided and maintained. Bridges shall be adequate in width and strength for the service required. No private road or driveway may be closed without approval of the ENGINEER unless written authority has been given by the OWNER whose property has been affected. Driveways shall be left open and ready for use at the end of the WORK shift. All expenses involved in providing for construction, maintenance, and use of private roads or driveways, shall be borne by the CONTRACTOR and the amount thereof absorbed in the unit prices of the CONTRACTOR’s bid.

1.11 TRAFFIC CONTROL AND PROTECTION

The CONTRACTOR shall maintain traffic control and protection in the WORK areas 24 hours per day. Traffic control shall conform to the standards set forth in the "Oregon Manual on Uniform Traffic Control Devices" issued by the Oregon Department of Transportation.

The CONTRACTOR shall conduct its operations to keep one lane of traffic open for public and private access at all times on City, County and Public streets, roads and highways. If required by the State, the CONTRACTOR shall conduct its operations to keep both directions of traffic open on State

Highways. Permits obtained for the project may have more stringent requirements than noted in this section.

Prior to beginning construction, the CONTRACTOR shall submit a detailed street closure and traffic control plan to the ENGINEER for approval. As construction proceeds, the CONTRACTOR shall notify the ENGINEER as to the status of street closures and detours.

On streets where traffic is heavy, the ENGINEER may require the construction of two-way bridges of adequate design. These bridges shall be provided with guard rails and shall be well lighted at all times. Detours as required by the ENGINEER shall be surfaced with gravel or crushed rock and maintained in good condition. Detours for pedestrians shall not exceed one block in length, and foot bridges over the trenches shall be provided with adequate handrails.

All WORK shall be carried on with due regard for safety to the public. Open trenches shall be provided with barricades of a type that can be seen at a reasonable distance, and at night they shall be distinctly indicated by adequately placed lights.

1.12 DECHLORINATION AND DISPOSAL OF CHLORINATED WATER

Any discharge of chlorinated water shall either be through an approved connection to a public sanitary sewer system or shall include de-chlorination to limits acceptable by the Oregon State Department of Environmental Quality (DEQ) for discharge into the existing storm drainage system. No chlorinated water shall be discharged into the storm drainage system prior to approved de-chlorination treatment.

1.13 FIELD CHANGES, ALIGNMENT, AND GRADE

See Article 11 of the General and Supplemental Conditions.

The CONTRACTOR shall locate existing utilities to be crossed, by potholing ahead of the pipe installation, of sufficient distance to avoid conflicts through pipe joint deflection if possible. All costs for minor field changes of alignment and grade shall be borne by the CONTRACTOR. The ENGINEER will endeavor to make prompt decisions on such matters. CONTRACTOR shall anticipate a minimum of 72 hours for any decision requiring significant piping change.

1.14 TESTING AND OPERATION OF FACILITIES

It is the intent of the OWNER to have a complete and operable facility. All the WORK under this contract will be fully tested and inspected in accordance with the SPECIFICATIONS. Upon completion of the WORK, the CONTRACTOR shall operate the completed facilities as required to test the equipment under the direction of the ENGINEER. During this period of operation by the CONTRACTOR, the new facilities will be tested thoroughly to determine their acceptance.

See Article 14 of the General and Supplementary Conditions and Section 01 75 16 Testing, Training & System Start-Up for additional requirements.

1.15 PROTECTION OF EXISTING STRUCTURES AND WORK

The CONTRACTOR must take all precautions and measures necessary to protect all existing structures and WORK. Any damage to existing structures and WORK shall be repaired by removing the damaged

structure or WORK, replacing the WORK and restoring to original condition satisfactory to the ENGINEER.

1.16 SALVAGE AND DEBRIS

Unless otherwise indicated on the DRAWINGS or in the SPECIFICATIONS, all castings, pipe, equipment, demolition debris, spoil or any other discarded material or equipment shall become the property of the CONTRACTOR and shall be disposed of in a manner compliant with applicable Federal, State, and local laws and regulations governing disposal of such waste products. No burning of debris or any other discarded material will be permitted. Recycling of materials shall be prioritized.

Items indicated to be salvaged and returned to OWNER shall be provided in same condition as was found by the CONTRACTOR.

1.17 SAFETY STANDARDS AND ACCIDENT PREVENTION

See Article 7 of the General and Supplementary Conditions.

1.18 PUBLIC SAFETY AND CONVENIENCE

General Rule: The CONTRACTOR shall ensure the safety of the public during its performance of the WORK and shall minimize any public inconvenience in addition to any other requirement imposed by law. These duties include, but are not limited to, the matters listed below.

Access: The CONTRACTOR shall not unreasonably restrict access to public facilities, commercial property, fire hydrants, residential property, and other areas where the public can be expected to be present, such as sidewalks and streets without first obtaining approval of the OWNER. Driveways shall be closed only with the approval of the OWNER or after obtaining specific permission from the property OWNER or OWNERs. In addition, the CONTRACTOR shall not obstruct or interfere with travel over any public street or sidewalk without approval of the OWNER.

Public Transit: The CONTRACTOR shall not interfere with the normal operation of any public transit vehicles unless otherwise authorized.

Work Site: The CONTRACTOR shall keep the Project site safe in compliance with applicable law. Safety includes, but is not limited to: 1) providing an approved type of secured and adequate barricades or fences that are easily visible from a reasonable distance around open excavations; 2) closing up or covering with steel plates all open excavations at the end of each Working Day in all street areas and in all other areas when it is reasonably required for public safety; 3) marking all open work and obstructions by lights at night; 4) installing and maintaining all necessary signs, lights, flares, barricades, railings, runways, stairs, bridges, and facilities; 5) observing any and all safety instructions received from the OWNER; and 6) following all laws and regulations concerning worker and public safety. In the event that the law requires greater safety obligations than that imposed by the OWNER, the CONTRACTOR shall comply with the law.

Emergency: Emergency vehicles, including but not limited to police, fire, and disaster units shall be provided access to the work site at all times.

Cleanliness: The CONTRACTOR shall, on a continuing basis, keep the surfaces of all public and private roadways, sidewalks, and other pathways free of dirt, mud, cold plane grindings, and other matters

that the CONTRACTOR may place upon the road. The cost of performing such WORK shall be included in the CONTRACTOR's Bid and no additional payment will be made for performing this task.

Parking: The CONTRACTOR shall make any necessary contacts with all applicable governmental bodies to arrange for the removal of parked automobiles, vehicles and other obstructions if they would interfere with the performance of the CONTRACTOR'S WORK.

Accidents: The CONTRACTOR'S Project Manager or superintendent shall be in charge of accident prevention. CONTRACTOR shall take all actions necessary to prevent damage, injury and loss to persons and property as a result of accidents.

Site Specific Safety Plan Certification: CONTRACTOR shall perform all operations in strict accordance with the Site Specific Safety Plan Certification attached at the end of this section. CONTRACTOR to return signed form to OWNER prior to any construction activities occurring on-site.

The OWNER has no responsibility for WORK site safety. WORK site safety is the responsibility of the CONTRACTOR. The CONTRACTOR is required to have a competent person on site at all times during construction activities.

The CONTRACTOR shall provide signs on work zone fencing that provide information regarding access to businesses and stating that such businesses are open and in operation. The CONTRACTOR shall furnish and install the signs and provide sign attachments for the various business names.

1.19 UTILITY PROPERTIES AND SERVICE

In areas where the CONTRACTOR's operations are adjacent to or near a utility and such operations may cause damage which might result in significant expense, loss and inconvenience, the operations shall be suspended until all arrangements necessary for the protection thereof have been made by the CONTRACTOR.

The CONTRACTOR shall notify all utility offices which may be affected by the construction operation at least 48 hours in advance. Before exposing any utility, the utility having jurisdiction shall grant permission and may oversee the operation. Should service of any utility be interrupted due to the CONTRACTOR's operation, the proper authority shall be notified immediately. It is of the utmost importance that the CONTRACTOR cooperates with the said authority in restoring the service as promptly as possible. Any costs shall be borne by the CONTRACTOR.

Utilities which may be impacted include the following:

Northwest Natural Gas	Natural Gas
Portland General Electric	Power
Water Environment Services	Sanitary Sewer
Clackamas County	Storm Sewer
City of Gladstone	Potable Water
Sunrise Water Authority	Potable Water

1.20 VEHICLE PARKING

The vehicles of the CONTRACTOR's and SUBCONTRACTOR's employees shall be parked in accordance with local parking ordinances.

1.21 PROTECTION OF QUALITY OF WATER

The WORK to be performed may involve connections to an existing potable water system. If such WORK is included in the project, the CONTRACTOR shall take such precautions as are necessary or as may be required to prevent the contamination of the water. Such contamination may include but shall not be limited to deleterious chemicals such as fuel, cleaning agents, paint, demolition and construction debris, sandblasting residue, etc. In the event contamination does occur, the CONTRACTOR shall, at its own expense, perform such WORK as may be necessary to repair any damage or to clean the affected areas of the water mains to a condition satisfactory to the ENGINEER.

1.22 SURVEYS

Based upon the information provided by the Contract Documents, the CONTRACTOR shall develop and make all detail surveys necessary for layout and construction, including exact component location, working points, lines, and elevations. Prior to construction, the field layout shall be approved by the OWNER's representative. The CONTRACTOR shall have the responsibility to carefully preserve benchmarks, reference points, and stakes, and in the case of destruction thereof by the CONTRACTOR or resulting from its negligence, the CONTRACTOR shall be charged with the expense and damage resulting therefore and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such benchmarks, reference points, and stakes.

1.23 DUST PREVENTION

All unpaved streets, roads, detours, haul roads, or other areas where dust may be generated shall receive an approved dust-preventive treatment or be routinely watered to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

1.24 EROSION AND SEDIMENTATION CONTROL

Erosion control measures shall be maintained throughout the project site until approved permanent ground cover such as healthy stand of grass, other permanent vegetation, or other ground covering is established and until the end of the improvements on the specific pump station site. When approved permanent ground cover is established, all temporary erosion control measures shall be removed from the construction site. Erosion control measures shall be installed as approved, per the erosion control drawing(s) in the above referenced document. Erosion control measures including stabilized construction entrances and sediment barriers must be established in conjunction with site clearing and grading.

During construction the erosion control facilities shall be upgraded as needed for unexpected storm events or site conditions and with the purpose of retaining sediment and sediment-laden water on the construction site.

1.25 INTERFERENCES, OBSTRUCTIONS, AND SEWER CROSSINGS

At certain places, power, light and telephone poles may interfere with excavation and the operation of the CONTRACTOR's equipment. Necessary arrangements shall be made with utility companies for moving or maintaining such poles. The utility company affected by any such interferences shall be notified thereof so that the necessary moving or proper care of poles and appurtenances may have appropriate attention.

All costs resulting from any other interferences and obstructions, or the replacement of such, whether or not herein specifically mentioned, shall be included and absorbed in the unit prices of the CONTRACTOR's bid.

1.26 NOISE LIMITATIONS

The project areas are located within a residential zoned area. All applicable City, County ordinances, and State and Federal regulations shall be complied with. Additional noise restrictions may be specified in other sections of the SPECIFICATIONS.

1.27 EMERGENCY MAINTENANCE SUPERVISOR

The CONTRACTOR shall submit to the ENGINEER the names, addresses, and telephone numbers of at least two employees responsible for performing emergency maintenance and repairs when the CONTRACTOR is not working. These employees shall be designated, in writing by the CONTRACTOR, to act as its representatives and shall have full authority to act on its behalf. At least one of the designated employees shall be available for a telephone call any time an emergency arises.

1.28 OREGON PRODUCTS

CONTRACTOR's attention is directed to the provisions of Oregon Law, ORS 279A.120 regarding the preference for products that have been manufactured or produced in Oregon. CONTRACTOR shall use Oregon-produced or manufactured materials with respect to common building materials such as cement, sand, crushed rock, gravel, plaster, etc., and Oregon-manufactured products in all cases where price, fitness, availability and quality are otherwise equal.

1.29 USE OF EXPLOSIVES

The use of explosives shall not be allowed on this project. Alternative methods of excavation shall be utilized.

1.30 FACILITY OPERATIONS REQUIREMENTS

The WORK included in these plans and SPECIFICATIONS is to be performed on a pump station that must continue in operation during construction. The CONTRACTOR shall always cooperate fully with the OWNER and the ENGINEER to ensure that the production capability of the pump station will continue and that any interruption to pump station operations are minimized. See specification 01 57 19.11 for further requirements

1.31 SPECIAL INSPECTIONS

Special inspections and testing as required by Chapter 17 of the IBC shall be conducted by Special Inspectors and Testing Agencies retained by the CONTRACTOR and approved by the OWNER as required and as indicated in the Contract Documents.

A. Special Inspectors and Testing Agencies Responsibilities

1. Verify that manufacturers maintain detailed fabrication and quality control procedures and review the completeness and adequacy of those procedures to perform the WORK.

2. Promptly notify OWNER, ENGINEER and CONTRACTOR of irregularities and deficiencies observed in the WORK during performance of their services.

3. Submit certified written report of each test, inspection and similar quality control service to OWNER, ENGINEER, CONTRACTOR and jurisdictional authorities. Interpret test results and inspections and state in each report whether tested and inspected WORK complies with or deviates from the Contract Documents.

4. Submit final report of special inspections at Substantial Completion, including a list of unresolved deficiencies.

5. Re-test and re-inspect corrected WORK.

B. CONTRACTOR'S Responsibilities

1. Provide quality requirements to all SUBCONTRACTORs and enforce all requirements.

2. Notify OWNER, ENGINEER, Special Inspectors and Testing Agencies at least 48 hours in advance of time when WORK that requires testing or special inspecting will be performed, unless otherwise indicated in the Contract Documents.

3. Pay for any CONTRACTOR requested testing and inspecting not required by the Contract Documents.

4. Pay for any re-testing or re-inspections by Special Inspectors and Testing Agencies for replacement WORK resulting from WORK that failed to comply with the Contract Documents. OWNER will deduct such costs from the Contract Price.

5. Submit copies of licenses, certifications, correspondence, records and similar documents used to establish compliance with standards and regulations that pertain to performance of the WORK to the OWNER, ENGINEER and Special Inspectors.

6. Where Special Inspection requires preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

    a. Provide test specimens representative of proposed products and construction in a timely manner with sufficient time for testing and analyzing results to prevent delaying the WORK.

    b. Provide information on configurations of test assemblies, testing procedures and laboratory test records to adequately demonstrate capability of products to comply with performance requirements.

7. Cooperate with Agencies performing required tests, special inspections and similar quality control services. Notify Agencies in advance of operations to permit assignment of personnel. Provide the following:

    a. Access to the WORK.

    b. Incidental labor, equipment and materials necessary to facilitate tests and special inspections.

    c. Adequate quantities of representative samples of materials that require testing and inspecting. Assist Agencies in obtaining samples.

    d. Provide facilities for storage and field curing of test samples.

e. Deliver samples to Testing Agencies.

8. Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and special inspecting.

9. Schedule times for tests, special inspections, obtaining samples and similar activities. Distribute schedule to OWNER, ENGINEER, Special Inspectors, Testing Agencies and each party involved in portions of the WORK where tests and special inspections are required.

1.32 ASBESTOS REMOVAL

The CONTRACTOR shall comply with all requirements of the State of Oregon, Department of Environmental Quality (DEQ) with respect to the safe handling, removal and disposal of asbestos, including all reporting requirements. Asbestos demolition work shall be performed in accordance with Section 02 41 00 Demolition. Information from DEQ is available online at:

https://www.oregon.gov/deq/Hazards-and-Cleanup/Pages/Asbestos-for-Businesses.aspx

END OF SECTION

SECTION 01 12 16 - WORK SEQUENCE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes general sequencing, project phasing and coordination requirements for the WORK.

B. Contract Requirements:

1. The existing pump stations continuously receive sewage. The functions of the facilities shall not be compromised during the course of the WORK, except as may be specified herein. Plan and prosecute the WORK such that the operation of the pump station is not interrupted, except as specified herein.

2. Pumping disruptions could potentially result in the spillage or discharge of sewage and sewage. State law allows the Department of Environmental Quality to impose civil penalties for violation of a term, condition, or requirement of OWNER's NPDES Permit, including spillage or discharge of sewage.

3. Spillage or discharge of sewage to surface waters or drainage courses is prohibited during construction. Penalties imposed on OWNER as a result of any bypass of this type caused by CONTRACTOR, its employees or SUBCONTRACTORs, and legal fees and other expenses to OWNER resulting directly or indirectly from the bypass shall be borne in full by CONTRACTOR.

4. Control any and all sewage resulting from or integral to making all temporary and permanent piping connections. Provide any and all devices required to control, stop, divert, or dispose of any and all sewage.

5. OWNER may determine the order of precedence and the time and season at which any portion or portions of the WORK shall be commenced and carried on to ensure proper completion of the Contract, proper operation of the pump station or compliance with NPDES Permit conditions.

6. Plan and prosecute the WORK such that temporary bypass pumping operations are provided in accordance with Section 01 57 19.11 Temporary Sewage Control and Bypass Pumping.

1.2 RELATED SECTIONS

A. Section 01 33 00 Submittal Procedures

B. Section 01 57 19.11 Temporary Sewage Control and Bypass Pumping

1.3 SUBMITTALS

A. Section 01 33 00 Submittal Procedures: Requirements for submittals.

B. WORK Sequencing Plan: At a minimum, to include the following:

1. Complete sequence of construction for all activities contained herein.

2. Major WORK activities to occur.

3. Schedule of temporary shutdowns of pump station and estimated duration of shutdowns. Submit a detailed plan for conveying sewage to the downstream collection system during temporary shutdowns in accordance with Section 01 57 19.11.

4. Listing of equipment to be present on site, including temporary pumping equipment to be used to bypass sewage around pump station during shutdowns.

5. Assistance to be required of OWNER's operating personnel during shutdowns.

6. Contingency plan identifying what action will be taken if activities during a shutdown cannot be completed within the allotted times, or if there is a failure of pumping equipment to be used during temporary pumping operations.

7. Name and contact information of individual in charge of activity during shutdown.

1.4 SCHEDULE A: SOUTH WELCHES PUMP STATION PROJECT SPECIFIC WORK CONSTRAINTS

A. Complete installation and testing and obtain ENGINEER's acceptance of the following components of the facility prior to a prolonged shutdown of the existing pump station:

1. Provide on-site all necessary bypassing equipment including temporary force main suction and discharge pipe, bypass pumps, baker tanks and bypass valve tee assembly.

2. Excavate and expose a portion of the existing force main as shown on plans.

3. Initiate bypass by installing suction lines as shown on plans and storing influent wastewater in baker tanks on site until bypass valve tee assembly is installed.

4. Begin pumping through bypass valve tee assembly as shown on plans.

5. Further demolition of the existing pumping system, piping, wet well lid or electrical equipment is NOT allowed until bypass pumping is installed and deemed operable by OWNER.

   a. CONTRACTOR may demo valve vault lid prior to bypassing efforts.

6. Install temporary H-20 rated ramps to maintain access for vehicles and vactor trucks to the site.

1.5 SCHEDULE B: GOLF CLUB TERRACE PUMP STATION PROJECT SPECIFIC WORK CONSTRAINTS

A. Complete installation and testing and obtain ENGINEER's acceptance of the following components of the facility prior to a prolonged shutdown of the existing pump station:

1. Provide on-site all necessary bypassing equipment including temporary force main suction and discharge pipe, bypass pumps, baker tanks and bypass valve tee assembly.

2. Excavate and expose a portion of the existing force main as shown on plans.

3. Initiate bypass by installing suction lines as shown on plans and storing influent wastewater in baker tanks on site until bypass valve tee assembly is installed.

4. Begin pumping through bypass valve tee assembly as shown on plans.

5. Further demolition of the existing pumping system, piping, wet well lid or electrical equipment is NOT allowed until bypass pumping is installed and deemed operable by OWNER.

    a. CONTRACTOR may demo valve vault lid prior to bypassing efforts.

6. Install temporary H-20 rated ramps to maintain access for vehicles and vactor trucks to the site.

1.6 SCHEDULE C: 82ND DRIVE PUMP STATION PROJECT SPECIFIC WORK CONSTRAINTS

A. Complete installation and testing and obtain ENGINEER's acceptance of the following components of the facility prior to a prolonged shutdown of the existing pump station:

1. Provide on-site all necessary bypassing equipment including temporary force main suction and discharge pipe, bypass pumps, baker tanks and bypass valve tee assembly.

2. Excavate and expose a portion of the existing force main as shown on plans.

3. Initiate bypass by installing suction lines as shown on plans until bypass valve tee assembly is installed.

4. Begin pumping through bypass valve tee assembly as shown on plans.

5. No demolition of the existing pumping system, piping, wet well lid or electrical equipment is allowed until bypass pumping is installed and deemed operable by OWNER.

1.7 SCHEDULE D: SIEBEN LANE PUMP STATION PROJECT SPECIFIC WORK CONSTRAINTS

A. Complete installation and testing and obtain ENGINEER's acceptance of the following components of the facility prior to a prolonged shutdown of the existing pump station. This includes the following work:

1. Close the valve that connects the 10-inch diameter force main to the 6-inch diameter force main and the valve upstream from the wye on the 6-inch diameter force main to isolate the 6-inch diameter force main so that it can be used for bypassing.

2. Drain the existing 6-inch diameter force main into the wet well using the branch portion of the wye while pumping through the 10-inch diameter force main.

3. Remove and plug the existing air injection port into the 6-inch diameter force main as shown on the Plans.

4. Remove the piping and valves as shown and install the proposed 6-inch diameter plug valve up stream of the 6-inch diameter wye.

5. Connect the bypass pumping discharge piping to the branch side of the 6-inch diameter wye.

6. Set up and begin bypass pumping operations per Section 01 57 19.11 using the 6-inch diameter force main.

7. Drain the 10-inch diameter force main into the wet well.

8. Remove and plug the existing air injection port into the 10-inch diameter force main as shown on the Plans.

9. No demolition of the existing pumping system, piping, wet well lid or electrical equipment is allowed until bypass pumping is installed and deemed operable by OWNER.

1.8 GENERAL WORK CONSTRAINTS

A. Constraints primarily relate to interfacing with and tying into existing pipelines, power supply, equipment, and other aspects of the operating pump station facility.

B. Make every effort to give proper attention to each of these items so as to minimize interruptions of the existing facilities and avoid delays that may result if the constraints are not observed.

C. Constraints listed below involve limits on activities during construction. These limits relate to the critical nature of the existing pump station facilities.

1. Coordinate construction schedule and operation with OWNER.

2. Coordinate proposed WORK with OWNER, ENGINEER, and facility operations personnel before implementing unit shutdowns. Under no circumstances cease WORK at the end of a normal working day if such actions may inadvertently cause a cessation of any facility operating process; in which case, remain on site until necessary WORK and/or repairs are complete.

3. OWNER recognizes portions of the facilities and facility operations will have to be interrupted or shut down or interfered with in order to accommodate construction activities. OWNER will, through its personnel, attempt to accommodate WORK, provided that proper notification is given. OWNER reserves the right to deny permission for interruption or shutdown on any day.

4. Do not operate any of the existing equipment without written permission from OWNER naming the specific piece of equipment, operator(s), and dates equipment may be used. CONTRACTOR is liable for any loss or damage caused to property or equipment or any personal injury resulting from or related to this usage.

D. Extended Working Hours: If it is desired to perform any WORK outside the specified working hours, obtain written permission from OWNER and all necessary permitting agencies, and make all necessary arrangements prior to commencing.

1.9 TEMPORARY SHUTDOWNS

A. Provide 14-day minimum advance notice to request approval of a temporary shutdown of a facility. This shall include shutdowns of the pump station or any utility serving the pump station (force main, gravity sewer, power service, etc).

B. Each Notice of Request for Approval of a Temporary Shutdown submitted to OWNER shall include the following:

1. Dates, times, and duration of proposed shutdown.

2. WORK activities to be performed during the shutdown.

3. Assistance required of OWNER's personnel before, during, and after shutdown.

4. Personnel to be on Site during shutdown.

5. Contingency plan if WORK during shutdown is not completed during allotted time or critical equipment fails.

C. Upon receipt of such request, OWNER will decide what action(s) is required by OWNER and if the requested shutdown is acceptable considering the flows through the pump station at that time. The request from CONTRACTOR will be returned to CONTRACTOR with the OWNER's written decision noted. If OWNER deems that the requested shutdown is unacceptable, OWNER will state such reasons, and CONTRACTOR shall reschedule the shutdown as required.

D. It is hereby agreed between the CONTRACTOR and OWNER that disapproval by OWNER of the CONTRACTOR's shutdown request does not entitle CONTRACTOR to any time extension unless CONTRACTOR can demonstrate to the satisfaction of OWNER, through an updated CPM schedule, that the overall Project completion date will not be met as a result of this disapproval.

E. OWNER may postpone a planned and approved shutdown at any time for pumping capacity, safety reasons, or weather conditions.

F. CONTRACTOR shall provide temporary bypass pumping system during all temporary shutdowns as specified in Section 01 57 19.11 Temporary Sewage Control and Bypass Pumping, unless otherwise approved by the ENGINEER.

1.10 INTERRUPTION OF UTILITY SERVICE

A. Indicate required shutdowns of existing utilities or interruptions of existing operations on Progress Schedule. Interruptions to utility service will be allowed to the extent that customer service will not be adversely compromised.

B. Submit requests for interruptions to utility service not less than five business days in advance of the date scheduled for the interruption.

C. Following receipt of the request, OWNER will notify CONTRACTOR if the requested date will be permitted. Evaluation of the request will be based upon the availability of the utility OWNER's personnel to assist and monitor utilities during the shutdown period and impact to customer service.

D. Minimize the period of interruption by thorough advance planning. Procure and provide all required materials, equipment and labor on site during the shutdown.

E. Do not begin interruption until written authorization is received from OWNER.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 22 20 - MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 Description

Measurement and payment of the WORK will be on a unit price basis in accordance with the prices set forth in the proposal for individual WORK items. Where WORK is required but does not appear as a separate item in the bid schedule, the cost for that WORK shall be included and absorbed in the lump sum price of the Pump Station Upgrades, Complete item for each pump station. CONTRACTOR shall make a careful assessment when preparing the bid and provide a breakdown of contract price lump sum items as required by Section 01 33 00 Submittal Procedures.

SCHEDULE A – SOUTH WELCHES PUMP STATION

A1. Mobilization, Bonds, Insurance and Demobilization:

Payment for mobilization, bonds, insurance and demobilization will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

A. When 5% is earned, either 100% of the amount for mobilization or 5% of the original contract amount, whichever is the least;

B. When all WORK is completed, amount of mobilization exceeding 5% of the original contract amount

This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

A2. Erosion and Sediment Control:

Payment for temporary erosion and sedimentation control will be on a lump sum basis. The lump sum price shall include compensation for transfer of the erosion control permit from the applicant to CONTRACTOR, and all labor, equipment, materials, planning and design for temporary erosion and sedimentation control measures, upkeep and maintenance of all measures, removal of erosion and sedimentation control measures at the completion of the Project, and all other materials and WORK necessary. The amounts paid for erosion and sedimentation control in the contract progress payment will be based on the percent of the original contract amount as follows:

A. 75% paid upon successful set up of erosion and sedimentation control per the DRAWINGS.
B. 25% paid upon successful removal of erosion and sedimentation control.

A3. Bypassing:

Payment for bypassing will be on a lump sum basis. Bypassing WORK shall be defined as all materials, labor, equipment, planning and design for bypassing of the South Welches Pump Station in accordance with Section 01 57 19.11 Temporary Sewage Control and Bypassing and as shown on the Plans.

A4. Existing Pump Station Demolition:

Payment for Existing Pump Station Demolition will be on a lump sum basis. Existing Pump Station Demolition WORK shall be defined as all materials and WORK related to the safe removal and disposal of the items at the South Welches Pump Station in accordance with Section 02 41 00 Demolition and as shown on the Plans. Demolition WORK to include some removal and salvaging of specified items in accordance with Section 02 41 00 Demolition and as shown on the Plans.

A5. Pump Station Upgrades, Complete:

Lump sum payment under this item shall cover all particular elements of the project, whether or not specifically or specially identified, as specified herein, in the contract documents and as shown on the plans, except for WORK included separately under separate bid items. Payment will be made on a lump sum basis for the completion of all WORK to the South Welches Pump Station. Pump station WORK shall be defined as all WORK not identified under separate bid items. Payment shall be full and complete compensation for all WORK shown in the DRAWINGS and other WORK required to provide complete and usable facilities including materials, equipment, and labor for construction. Payment shall also include the furnishing of all required record DRAWINGS, operation and maintenance manuals, and other documents, certifications and reporting specified herein.

A6. Power System Study:

Payment for Power System Study will be on a lump sum basis. Power System Study WORK shall be defined as all materials and WORK related to perform an arc flash study on all existing and new equipment, furnish an arc flash study report, and furnish and install all Arc Flash Warning labels per the code.

A7. Asbestos Survey:

Payment for Asbestos Survey will be on a lump sum basis for an Oregon Department of Environmental Quality (DEQ) accredited asbestos inspector to conduct a survey, collect samples, and submit a report meeting DEQ requirements.

A8. Asbestos Removal and Disposal:

Payment for removal and disposal of asbestos materials required to complete the work will be made through force account for all labor, equipment, and expenses meeting DEQ requirements. A budget allotment will be inserted into the bid schedule for all bidders.

SCHEDULE B – GOLF CLUB TERRACE PUMP STATION

B1. Mobilization, Bonds, Insurance and Demobilization:

Payment for mobilization, bonds, insurance and demobilization will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

A. When 5% is earned, either 100% of the amount for mobilization or 5% of the original contract amount, whichever is the least;

B. When all WORK is completed, amount of mobilization exceeding 5% of the original contract amount

This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

B2. Erosion and Sediment Control:

Payment for temporary erosion and sedimentation control will be on a lump sum basis. The lump sum price shall include compensation for transfer of the erosion control permit from the applicant to CONTRACTOR, and all labor, equipment, materials, planning and design for temporary erosion and sedimentation control measures, upkeep and maintenance of all measures, removal of erosion and sedimentation control measures at the completion of the Project, and all other materials and WORK necessary. The amounts paid for erosion and sedimentation control in the contract progress payment will be based on the percent of the original contract amount as follows:

A. 75% paid upon successful set up of erosion and sedimentation control per the DRAWINGS.
B. 25% paid upon successful removal of erosion and sedimentation control.

B3. Bypassing:

Payment for bypassing will be on a lump sum basis. Bypassing WORK shall be defined as all materials, labor, equipment, planning and design for bypassing of the Golf Club Terrace Pump Station in accordance with Section 01 57 19.11 Temporary Sewage Control and Bypassing and as shown on the Plans.

B4. Existing Pump Station Demolition:

Payment for Existing Pump Station Demolition will be on a lump sum basis. Existing Pump Station Demolition WORK shall be defined as all materials and WORK related to the safe removal and disposal of the items at the Golf Club Terrace Lane Pump Station in accordance with Section 02 41 00 Demolition and as shown on the Plans. Demolition WORK to include some removal and salvaging of specified items in accordance with Section 02 41 00 Demolition and as shown on the Plans.

B5. Pump Station Upgrades, Complete:

Lump sum payment under this item shall cover all particular elements of the project, whether or not specifically or specially identified, as specified herein, in the contract documents and as shown on the plans, except for WORK included separately under separate bid items. Payment will be made on a lump sum basis for the completion of all WORK to the Golf Club Terrace Lane Pump Station. Pump station WORK shall be defined as all WORK not identified under separate bid items. Payment shall be full and complete compensation for all WORK shown in the DRAWINGS and other WORK required to provide complete and usable facilities including materials, equipment, and labor for construction. Payment shall also include the furnishing of all required record DRAWINGS, operation and maintenance manuals, and other documents, certifications and reporting specified herein. The CONTRACTOR shall provide a breakdown of contract price as required by Section 01 33 00 Submittal Procedures.

B6. Power System Study:

Payment for Power System Study will be on a lump sum basis. Power System Study WORK shall be defined as all materials and WORK related to perform an arc flash study on all existing and new equipment, furnish an arc flash study report, and furnish and install all Arc Flash Warning labels per the code.

B7. Asbestos Survey:

Payment for Asbestos Survey will be on a lump sum basis for an Oregon Department of Environmental Quality (DEQ) accredited asbestos inspector to conduct a survey, collect samples, and submit a report meeting DEQ requirements.

B8. Asbestos Removal and Disposal:

Payment for removal and disposal of asbestos materials required to complete the work will be made through force account for all labor, equipment, and expenses meeting DEQ requirements. A budget allotment will be inserted into the bid schedule for all bidders.

SCHEDULE C – 82nd DR PUMP STATION

C1. Mobilization, Bonds, Insurance and Demobilization:

Payment for mobilization, bonds, insurance and demobilization will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

A. When 5% is earned, either 100% of the amount for mobilization or 5% of the original contract amount, whichever is the least;

B. When all WORK is completed, amount of mobilization exceeding 5% of the original contract amount

This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

C2. Erosion and Sediment Control:

Payment for temporary erosion and sedimentation control will be on a lump sum basis. The lump sum price shall include compensation for transfer of the erosion control permit from the applicant to CONTRACTOR, and all labor, equipment, materials, planning and design for temporary erosion and sedimentation control measures, upkeep and maintenance of all measures, removal of erosion and sedimentation control measures at the completion of the Project, and all other materials and WORK necessary. The amounts paid for erosion and sedimentation control in the contract progress payment will be based on the percent of the original contract amount as follows:

A. 75% paid upon successful set up of erosion and sedimentation control per the DRAWINGS.
B. 25% paid upon successful removal of erosion and sedimentation control.

C3. Bypassing:

Payment for bypassing will be on a lump sum basis. Bypassing WORK shall be defined as all materials, labor, equipment, planning and design for bypassing of the Golf Club Terrace Pump Station in accordance with Section 01 57 19.11 Temporary Sewage Control and Bypassing and as shown on the Plans.

C4. Existing Pump Station Demolition:

Payment for Existing Pump Station Demolition will be on a lump sum basis. Existing Pump Station Demolition WORK shall be defined as all materials and WORK related to the safe removal and disposal of the items at the Golf Club Terrace Lane Pump Station in accordance with Section 02 41 00 Demolition and as shown on the Plans. Demolition WORK to include some removal and salvaging of specified items in accordance with Section 02 41 00 Demolition and as shown on the Plans.

C5. Pump Station Upgrades, Complete:

Lump sum payment under this item shall cover all particular elements of the project, whether or not specifically or specially identified, as specified herein, in the contract documents and as shown on the plans, except for WORK included separately under separate bid items. Payment will be made on a lump sum basis for the completion of all WORK to the Golf Club Terrace Lane Pump Station. Pump station WORK shall be defined as all WORK not identified under separate bid items. Payment shall be full and complete compensation for all WORK shown in the DRAWINGS and other WORK required to provide complete and usable facilities including materials, equipment, and labor for construction. Payment shall also include the furnishing of all required record DRAWINGS, operation and maintenance manuals, and other documents, certifications and reporting specified herein. The CONTRACTOR shall provide a breakdown of contract price as required by Section 01 33 00 Submittal Procedures.

C6. Power System Study:

Payment for Power System Study will be on a lump sum basis. Power System Study WORK shall be defined as all materials and WORK related to perform an arc flash study on all existing and new equipment, furnish an arc flash study report, and furnish and install all Arc Flash Warning labels per the code.

C7. Asbestos Survey:

Payment for Asbestos Survey will be on a lump sum basis for an Oregon Department of Environmental Quality (DEQ) accredited asbestos inspector to conduct a survey, collect samples, and submit a report meeting DEQ requirements.

C8. Asbestos Removal and Disposal:

Payment for removal and disposal of asbestos materials required to complete the work will be made through force account for all labor, equipment, and expenses meeting DEQ requirements. A budget allotment will be inserted into the bid schedule for all bidders.

SCHEDULE D – SIEBEN LANE PUMP STATION

D1. Mobilization, Bonds, Insurance and Demobilization:

Payment for mobilization, bonds, insurance and demobilization will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

A. When 5% is earned, either 100% of the amount for mobilization or 5% of the original contract amount, whichever is the least;

B. When all WORK is completed, amount of mobilization exceeding 5% of the original contract amount

This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

D2. Erosion and Sediment Control:

Payment for temporary erosion and sedimentation control will be on a lump sum basis. The lump sum price shall include compensation for transfer of the erosion control permit from the applicant to CONTRACTOR, and all labor, equipment, materials, planning and design for temporary erosion and sedimentation control measures, upkeep and maintenance of all measures, removal of erosion and sedimentation control measures at the completion of the Project, and all other materials and WORK necessary. The amounts paid for erosion and sedimentation control in the contract progress payment will be based on the percent of the original contract amount as follows:

A. 75% paid upon successful set up of erosion and sedimentation control per the DRAWINGS.
B. 25% paid upon successful removal of erosion and sedimentation control.

D3. Bypassing:

Payment for bypassing will be on a lump sum basis. Bypassing WORK shall be defined as all materials, labor, equipment, planning and design for bypassing of the Sieben Lane Pump Station in accordance with Section 01 57 19.11 Temporary Sewage Control and Bypassing and as shown on the Plans. The amounts paid for Bypassing in the contract progress payment shall be made monthly as a percentage of the original contract amount for this bid item.

D4. Existing Pump Station Demolition:

Payment for Existing Pump Station Demolition will be on a lump sum basis. Existing Pump Station Demolition WORK shall be defined as all materials and WORK related to the safe removal and disposal of the items at the Sieben Lane Pump Station in accordance with Section 02 41 00 Demolition and as shown on the Plans. Demolition WORK to include some removal and salvaging of specified items in accordance with Section 02 41 00 Demolition and as shown on the Plans.

D5. Pump Station Upgrades, Complete:

Lump sum payment under this item shall cover all particular elements of the project, whether or not specifically or specially identified, as specified herein, in the contract documents and as shown on the plans, except for WORK included separately under separate bid items. Payment will be made on a

lump sum basis for the completion of all WORK to the Sieben Lane Pump Station. Pump station WORK shall be defined as all WORK not identified under separate bid items. Payment shall be full and complete compensation for all WORK shown in the DRAWINGS and other WORK required to provide complete and usable facilities including materials, equipment, and labor for construction. Payment shall also include the furnishing of all required record DRAWINGS, operation and maintenance manuals, and other documents, certifications and reporting specified herein. The CONTRACTOR shall provide a breakdown of contract price as required by Section 01 33 00 Submittal Procedures.

D6. Power System Study:

Payment for Power System Study will be on a lump sum basis. Power System Study WORK shall be defined as all materials and WORK related to perform an arc flash study on all existing and new equipment, furnish an arc flash study report, and furnish and install all Arc Flash Warning labels per the code.

D7. Asbestos Survey:

Payment for Asbestos Survey will be on a lump sum basis for an Oregon Department of Environmental Quality (DEQ) accredited asbestos inspector to conduct a survey, collect samples, and submit a report meeting DEQ requirements.

D8. Asbestos Removal and Disposal:

Payment for removal and disposal of asbestos materials required to complete the work will be made through force account for all labor, equipment, and expenses meeting DEQ requirements. A budget allotment will be inserted into the bid schedule for all bidders.

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SECTION 01 32 00 - ELECTRONIC DOCUMENT MANAGEMENT SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

A. The OWNER and CONTRACTOR shall utilize an OWNER provided Procore Construction Software (Procore), for electronic submittal of all data and documents throughout the duration of the Contract. Procore is a web-based electronic media site. The OWNER furnished Procore site will be made available to all CONTRACTOR's project personnel, SUBCONTRACTOR personnel, suppliers, consultants and the Designer of Record. The joint use of this system is to facilitate; electronic exchange of information, automation of key processes, and overall management of the Contract. Procore shall be the primary means of Project information submission and management. When required by the OWNER's Representative, paper documents will also be provided. In the event of discrepancy between the electronic version and paper documents the paper documents will govern. Procore is a registered trademark of Procore Technologies, Incorporated.

1.2 USER ACCESS LIMITATIONS

A. The OWNER's Representative will control the CONTRACTOR's access to Procore by allowing access and assigning user profiles to accepted CONTRACTOR personnel. User profiles will define levels of access into the system, determine assigned function-based authorizations (determines what can be seen), and user privileges (determines what they can do). SUBCONTRACTORs and suppliers will be given access to Procore through the CONTRACTOR. Entry of information exchanged and transferred between the CONTRACTOR and its SUBCONTRACTORs and suppliers on Procore shall be the responsibility of the CONTRACTOR.

B. Joint Ownership of Data: Data entered in a collaborative mode (entered with the intent to share as determined by permissions and workflows within Procore by the OWNER's Representative and the CONTRACTOR will be jointly owned.

1.3 AUTOMATED SYSTEM NOTIFICATION AND AUDIT LOG TRACKING

A. Review comments made (or lack thereof) by the OWNER on CONTRACTOR submitted documentation shall not relieve the CONTRACTOR from compliance with requirements of the Contract Documents. The CONTRACTOR is responsible for managing, tracking, and documenting the Work to comply with the requirements of the Contract Documents. OWNER's acceptance via automated system notifications or audit logs extends only to the face value of the submitted documentation and does not constitute validation of the CONTRACTOR's submitted information.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittal Procedures.

1.5 COMPUTER REQUIREMENTS

A. The CONTRACTOR shall use computer hardware and software that meets the requirements of the OWNER furnished Procore site as recommended by Procore to access and utilize the

Procore site. As recommendations are modified by Procore, the CONTRACTOR will upgrade their system(s) to meet the recommendations or better. Upgrading of the CONTRACTOR's computer systems will not be justification for a cost or time modification to the Contract. The CONTRACTOR will ensure that connectivity to the EDMS (whether at the home office or jobsite) is accomplished through DSL, cable, T-l, or wireless communications systems. The minimum bandwidth requirements for using the system is 128 kb/s. It is recommended a faster connection be used when uploading pictures and files into the system. PWCM currently supports Mozilla's Firefox, Apple's Safari, Microsoft's Internet Explorer, and Google Chrome web browsers for accessing the application.

1.6 CONTRACTOR RESPONSIBILITY

A. The CONTRACTOR shall be responsible for the validity of their information placed in Procore and for the abilities of their personnel. Accepted users shall be knowledgeable in the use of computers, including Internet browsers, email programs, CAD drawing applications, and Adobe Portable Document Format (PDF) document distribution program. The CONTRACTOR shall utilize the existing forms in Procore to the maximum extent possible. If a form does not exist in the Procore, the CONTRACTOR must include a form of their own or provided by the OWNER's Representative as an attachment to a submittal. Adobe PDF documents will be created through electronic conversion rather than optically scanned whenever possible. The CONTRACTOR is responsible for the training of their personnel in the use of the Procore (outside what is provided by the OWNER) and the other programs indicated above as needed.

1.7 USER ACCESS ADMINISTRATION

A. Provide a list of CONTRACTOR's key Procore personnel for the OWNER's Representative acceptance. CONTRACTOR is responsible for adding and removing users from the system. The OWNER's Representative reserves the right to perform a security check on all potential users. The CONTRACTOR will be allowed to add additional personnel and SUBCONTRACTORs to the Procore.

1.8 CONNECTIVITY PROBLEMS

A. Procore is a web-based environment and therefore subject to the inherent speed and connectivity problems of the Internet. The CONTRACTOR is responsible for its own connectivity to the Internet. Procore response time is dependent on the CONTRACTOR's equipment, including processor speed, Internet access speed, etc., and current traffic on the Internet. The OWNER will not be liable for any delays associated from the usage of Procore including, but not limited to slow response time, downtime periods, connectivity problems, or loss of information. The CONTRACTOR will ensure that connectivity to Procore (whether at the home office or jobsite) is accomplished through DSL, cable, T-l, or wireless communications systems. The minimum bandwidth requirements for using the system is 128 kb/s. It is recommended a faster connection be used when uploading pictures and files into the system. Under no circumstances shall the usage of Procore be grounds for a time extension or cost adjustment to the Contract.

1.9 TRAINING

A. The Project OWNER has arranged for up to two training sessions to be offered for CONTRACTOR and SUBCONTRACTOR personnel to be coordinated at a time arranged by

CONTRACTOR with OWNER's Representative within 21 days of Notice to Proceed. CONTRACTOR participation in training is strongly encouraged and shall be considered incidental to the Work.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. ***Procore Construction Software*** project management application. Provided by Procore Technologies, Inc. www.procore.com

PART 3 EXECUTION

3.1 EDMS UTILIZATION

A. ***Procore*** shall be utilized in connection with submittal preparation and information management required by Sections:

Section 01 10 00 Summary of Work
Section 01 33 00 Submittal Procedures

and other Division One sections. Requirements of this section are in addition to requirements of all other sections of the specifications.

B. Design Document Submittals - All design drawings and specifications shall be submitted as CAD .dwg files or PDF attachments to the ***Procore*** submittal work flow process and form.

C. Shop Drawings - Shop drawing and design data documents shall be submitted as cad.dwg files or PDF attachments to the ***Procore*** submittal work flow process and form. Examples of shop drawings include, but are not limited to:

1. Standard manufacturer installation drawings.
2. Drawings prepared to illustrate portions of the work designed or developed by the CONTRACTOR.
3. Steel fabrication, piece, and erection drawings.

D. Product Data - Product catalog data and manufacturers instructions shall be submitted as PDF attachments to the ***Procore*** submittal work flow process and form. Examples of product data include, but are not limited to:

1. Manufacturer's printed literature.
2. Preprinted product specification data and installation instructions.

E. Samples - Sample submittals shall be physically submitted as specified in Section 01 33 00 Submittal Procedures. CONTRACTOR shall enter submittal data information into ***Procore*** with a copy of the submittal form(s) attached to the sample. Examples of samples include, but are not limited to:

1. Product finishes and color selection samples.

2. Product finishes and color verification samples.
3. Finish/color boards.
4. Physical samples of materials.

F. Administrative Submittals - All correspondence and pre-construction submittals shall be submitted using ***Procore***. Examples of administrative submittals include, but are not limited to:

1. Digging permits and notices for excavation.

2. List of product substitutions

3. List of contact personnel.

4. Notices for roadway interruption, work outside regular hours, and utility cut overs.

5. Requests for Information (RFI).

6. Plans for safety, demolition, environmental protection, and similar activities.

7. Quality Control Plan(s), Testing Plan and Log, Quality Control Reports, Production Reports, Quality Control Specialist Reports, Preparatory Phase Checklist, Initial Phase Checklist, Field Test reports, Summary reports, Rework Items List, etc.

8. Meeting minutes for quality control meetings, progress meetings, pre- installation meetings, etc.

9. Any general correspondence submitted.

G. Compliance Submittals Test reports, certificates, and manufacture field report submittals shall be submitted on ***Procore*** as PDF attachments. Examples of compliance submittals include, but are not limited to:

1. Field test reports.

2. Quality Control certifications.

3. Manufacturers documentation and certifications for quality of products and materials provided.

H. Record and Closeout Submittals - Operation and maintenance data and closeout submittals shall be submitted on ***Procore*** as PDF documents during the approval and review stage as specified, with actual set of documents submitted for final. Examples of record submittals include, but are not limited to:

1. Operation and Maintenance Manuals: Final documents shall be submitted as specified.

2. As-built Drawings: Final documents shall be submitted as specified.

3. Extra Materials, Spare Stock, etc.: Submittal forms shall indicate when actual materials are submitted.

I. Financial Submittals Schedule of Value, Pay Estimates and Change Request Proposals shall be submitted on ***Procore***. Supporting material for Pay Estimates and Change Requests shall be

submitted on *Procore* as PDF attachments. Examples of compliance submittals include, but are not limited to:

1. CONTRACTOR's Schedule of Values
2. CONTRACTOR's Monthly Progress Payment Requests
3. Contract Change proposals requested by the project OWNER.

END OF SECTION

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SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This Section contains administrative and procedural requirements for submittals for review, information, and for Project closeout.

B. Section includes:

1. Schedule of Submittals.
2. Submittal requirements.
3. Submittal procedures.
4. Engineer review.
5. Resubmittal procedures.
6. Product data.
7. Shop Drawings.
8. Samples.
9. Design data.
10. Test reports.
11. Certificates.
12. Manufacturer's instructions.
13. Manufacturer's field reports.
14. Erection Drawings.
15. Construction progress schedules.
16. Breakdown of contract price.
17. Construction photographs.
18. Operation and maintenance (O&M) instructions.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SCHEDULE OF SUBMITTALS

A. Within 10 days after the Effective Date of the Contract, Contractor shall submit to Engineer a preliminary Schedule of Submittals, including proposed list of major products proposed for use, with specification section reference, name of Manufacturer, supplier, trade name, subcontractor, and model number of each product. Provide a schedule of specific target dates for the submission and return of submittals and shop drawings required by the Contract Documents.

B. For products specified only by reference standards, indicate Manufacturer, trade name, model or catalog designation, and reference standards.

C. The list and schedule shall be updated and resubmitted when requested by the Engineer.

D. Contractor's Schedule of Submittals will be acceptable to the Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

1.4 SHOP DRAWING AND SAMPLE SUBMITTAL REQUIREMENTS

A. Before submitting a Shop Drawing or Sample, Contractor shall have:

1. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

2. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

3. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

4. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

B. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

C. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review of each such variation.

1.5 SUBMITTAL PROCEDURES

A. Contractor shall submit Shop Drawings and Samples to Engineer for review in accordance with the accepted Schedule of Submittals.

B. Transmit each submittal with Engineer-accepted transmittal form certifying compliance with requirements of Contract Documents.

C. Sequentially number transmittal forms. Mark transmittal forms for resubmittals with original number and sequential alphabetic suffix.

D. Show each Submittal with the following numbering and tracking system:

1. Submittals shall be numbered according to specification section. For example, the first product submittal for Section 05 50 00 would be "05 50 00-1". Resubmittals of that submittal would be "05 50 00-1.1", followed by "05 50 00-1.2", and so on. The second product submittal for that Section would be "05 50 00-2".

2. Submittals containing product information from multiple sections of the specifications will not be reviewed. Contractor and/or their supplier shall divide submittals in a manner that meets the numbering and tracking system requirements stated herein.

3. Alternative method of numbering may be used if acceptable to Engineer.

E. Identify: Project, Contractor, subcontractor and supplier, pertinent drawing and detail number, and specification Section number appropriate to submittal.

F. Apply Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work and Contract Documents.

G. Coordinate submission of related items.

1. All shop drawings for interrelated items shall be scheduled for submission at the same time.

2. The Engineer may hold shop drawings in cases where partial submission cannot be reviewed until the complete submission has been received or where shop drawings cannot be reviewed until correlated items affected by them have been received. When such shop drawings are held, the Engineer will advise the Contractor in writing that the shop drawing submitted will not be reviewed until shop drawings for all related items have been received.

H. When hard copies of submittals are provided by the Contractor, six copies of all materials shall be provided to the Engineer. Two copies of reviewed submittals will be kept by the Engineer, two copies of reviewed submittals will be transmitted to the Owner, and two copies of reviewed submittals will be returned to the Contractor. If the Contractor requests that more than two copies of the reviewed submittal be returned, then the Contractor shall submit the appropriate quantity of submittals.

I. When electronic transmittals of submittals are provided by the Contractor under established protocols described elsewhere in the Contract Documents or as jointly developed by the Owner, Engineer and Contractor, provide electronic submittals in portable document format (PDF) in addition to the source document format (Word, Excel, AutoCAD, etc.). Reviewed submittals will be returned to the Contractor as PDF electronic files.

J. For each submittal for review, allow not less than 14 days for Engineer review, excluding delivery time to and from Contractor.

K. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

L. Allow space on submittals for Contractor and Engineer review stamps or comments.

M. When revised for resubmission, the Contractor shall identify changes made since previous submission. A narrative of changes shall be provided, and shop drawings or calculations shall indicate that a revision was made.

N. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with review comments.

O. Submittals not requested will not be recognized nor processed.

P. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Engineer.

1.6 ENGINEER REVIEW

A. Informational submittals and other similar data are for Engineer's information, do not require Engineer's responsive action, and will not be reviewed or returned with comment.

B. The Engineer's review of submittals and shop drawings is not a check of any dimension or quantity and will not relieve the Contractor from responsibility for errors of any sort in the submittals and shop drawings.

C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

D. The Engineer will review the submitted data and shop drawings and return to the Contractor with notations thereon indicating "No Exception Taken", "Make Corrections Noted", "Rejected", "Revise and Resubmit", or "Submit Specified Item".

E. If more than two submissions of an item are required to meet the Project specifications, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

F. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

G. Engineer's review will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

H. Engineer's review of a separate item as such will not indicate approval of the assembly in which the item functions.

I. Engineer's review of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 1.4.C and Engineer has given written acceptance of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such accepted variation from the requirements of the Contract Documents in a Field Order.

J. Engineer's review of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 1.4 A. and B.

K. Engineer's review of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

L. Neither Engineer's receipt, review, return of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

M. Contractor shall perform the Work in compliance with the requirements and commitments set forth in returned Shop Drawings and Samples, subject to the provisions of Paragraph 1.6.I.

1.7 RESUBMITTAL PROCEDURES

A. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

B. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required review of an item with no more than two submittals. Engineer will record Engineer's time for reviewing a third or subsequent submittal of a Shop Drawings, sample, or other item requiring review, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

C. If Contractor requests a change of a previously reviewed submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

PART 2 PRODUCTS

2.1 CONSTRUCTION PROGRESS SCHEDULES

A. Within 10 days after the Effective Date of the Contract, prepare and submit to the Engineer a practicable schedule showing the order in which the Contractor proposes to carry out the Work, the dates on which the important features of the work will start, and the contemplated dates for completing same. A time-scaled bar chart schedule shall include the following:

- Construction activities
- Submittal and review of critical material samples and shop drawings
- Procurement and delivery of critical materials
- Duration of work, including completion times of all stages and their sub-phases

B. Attention is drawn to typical local climatic weather patterns and Work shall be coordinated accordingly.

2.2 BREAKDOWN OF CONTRACT PRICE

A. Within 10 days after the Effective Date of the Contract, submit a complete breakdown of all lump sum bid items showing the value assigned to each part of the work, including an allowance for profit and overhead adding up to the total lump sum contract price.

B. Breakdown of lump sum bids shall be coordinated with the items in the schedule and shall be in sufficient detail to serve as the basis for progress payments during construction.

C. Engineer will review the contract price breakdown and may request items to be further broken down or for more items be added in order to facilitate tracking of work progress for payment.

D. Preparatory work, bonds, and insurance required in setting up the job will be allowed as a separate entry on the cost breakdown but shall not exceed 5 percent of the total base bid.

E. Upon acceptance of the breakdown of the contract price by the Engineer, it shall be used as the basis for all requests for payment.

2.3 PRODUCT DATA

A. Product Data: Action Submittal: Submit to Engineer for review for assessing conformance with information given and design concept expressed in Contract Documents. Submitted data shall be sufficient in detail for determination of compliance with the Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement Manufacturers' standard data to provide information specific to this Project.

1. Note submittal will be returned to Contractor without review of submittal if products, models, options, and other data are not clearly marked or identified.

C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.4 SHOP DRAWINGS

A. Shop Drawings: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer licensed in the state of Project, responsible for designing components shown on Shop Drawings.

1. Include signed and sealed calculations to support design.

2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.

3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. All dimensioned shop drawings shall be scalable and provided as full-sized (22-inch x 34-inch) sheets. PDF electronic files shall print as scalable full-sized sheets.

E. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.5 SAMPLES

A. Samples: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Samples for Selection as Specified in Product Sections:

1. Submit to Engineer for aesthetic, color, and finish selection.
2. Submit Samples of finishes, textures, and patterns for Owner selection.

C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each Sample, with full Project information.

E. Submit number of Samples specified in individual Specification Sections; Engineer will retain one Sample.

F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.

G. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.6 DESIGN DATA

A. Informational Submittal: Submit data for Engineer's knowledge as Contract administrator or for Owner.

B. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.

2.7 TEST REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

2.8 CERTIFICATES

A. Informational Submittal: Submit certification by Manufacturer, installation/application Subcontractor, or Contractor to Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

2.9 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: Submit Manufacturer's installation instructions for Engineer's knowledge as Contract administrator or for Owner.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

2.10 MANUFACTURER'S FIELD REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit report within 48 hours of observation to Engineer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

2.11 ERECTION DRAWINGS

A. Informational Submittal: Submit Drawings for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit Drawings for information assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

1.1 PROJECT HEALTH AND SAFETY PROGRAM

D. Develop, publish, and implement an overall Project Health and Safety Program for the Project. This Program shall conform to all applicable codes. The written Safety Program shall be provided within 30 days after the receipt of the written Notice to Proceed. The Plan shall be assembled to address project specific health and safety issues to both the public and on-site personnel. The plan shall include at a minimum the following items when they apply:

1. Employee orientation
2. Safety inspections
3. Instruction and training
4. Accident reporting
5. Signs and barricades
6. Fire prevention and protection

7. Welding, cutting, and burning
8. Painting and surface treatment
9. Electricity
10. Machinery and mechanized equipment
11. Excavations
12. Sanitation
13. Chlorine safety
14. Hazardous materials
15. Hazardous communications program
16. Job hazard analysis
17. First aid/medical facilities
18. Personal protective equipment
19. Confined space entry plan
20. Shoring plan
21. Fall protection plan
22. Emergency Action Plan
23. Housekeeping
24. Safety training requirements and certification
25. Pedestrian access around work site during construction and after hours
26. Neighboring residences/community access and safety

E. If the Project requires other health and safety issues to be addressed, they too shall be included in the Project Health and Safety Program. The Program shall subsequently be distributed to and implemented by the Contractor's personnel, as well as its Subcontractors and Suppliers, the Owner and Engineer. Contractor shall fully implement and comply with the Safety Program and shall submit to the Owner a letter signed by Contractor's owner/president affirming such implementation and compliance within 15 days after on-site work has started. Contractor shall notify the Owner and Engineer when safety meetings will be held so that Owner's and Engineer's personnel may attend. A copy of the Health and Safety Program must be maintained on-site at all times during the life of the Project.

2.12 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

A. Submit preliminary O&M materials for review by Engineer. The Equipment Manufacturer may furnish instruction manuals prepared specifically for the equipment furnished or standard manuals may be used if statements like "if your equipment has this accessory..." or listings of equipment not furnished are eliminated. O&M materials will be returned to the Contractor for resubmittal if the O&M materials do not clearly indicate what specific equipment was furnished and all items not provided being clearly crossed out. Poorly reproduced copies are not acceptable. Operation and maintenance instructions shall contain the following as a minimum:

1. Reviewed shop drawings and submittal data;
2. Model, type, size, and serial numbers of equipment furnished;
3. Equipment and driver nameplate data;
4. List of parts showing replacement numbers;
5. Recommended list of spare parts;
6. Complete operating instructions including start-up, shutdown, adjustments, cleaning, etc.;
7. Maintenance and repair requirements including frequency and detailed instructions; and
8. Name, address and phone numbers of local representative and authorized repair service.

B. Following review of the preliminary O&M materials by the Engineer and before acceptance of the Work, submit four copies of complete final operation and maintenance instructions for all equipment supplied. Submit items in 8-1/2 x 11-inch heavy-duty three-ring binders when appropriate, or in 8-1/2 x 11-inch file folders. All binders and folders shall have clear plastic pockets on the front of the cover and the spine to allow for insertion of identifying information.

2.13 OTHER REQUIRED SUBMITTALS

A. Other required submittals include the items listed below. This list is provided for Contractor's convenience only and may not be complete in all respects. Contractor shall provide all submittals specified or required, whether or not listed here.

1. Contractor Emergency Contact List.

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 41 20 - SEISMIC REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

A. This section contains seismic design requirements for non-structural equipment, components and systems. The components and systems indicated below are required for immediate re-occupancy and minimization of disruption to operations following a seismic event. All elements shall meet the requirements of this section and Chapter 13 of ASCE 7-16.

B. Applicable Specification Divisions include those with:

1. Components that are part of the Designated Seismic Systems as covered in the 2022 OSSC Section 1705.13.3 and subject to the requirements of ASCE 7 Section 13.2.2.

2. Components weighing more than 400 pounds that have a center of mass located 4-feet or less above the adjacent floor or roof level that supports the component.

3. Components weighing more than 20 pounds, or more than 5 lbs./ft. in the case of distributed systems, located more than 4-feet above the adjacent floor or roof level that supports the component.

4. Exceptions:

   a. Furniture

   b. Temporary or movable equipment

   c. Mechanical and electrical components in Seismic Design Category B

   d. Mechanical and electrical components in Seismic Design Category C provided that either:

      1) The component Importance Factor, Ip, is equal to 1.0 and the component is positively attached to the structure; or

      2) The component weighs 20 lbs or less

1.2 RELATED SECTIONS:

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. General provisions within other Specification Divisions related to hangers, anchors, supports and seismic restraint or seismic control.

1.3 DEFINITIONS

A. Active – An active system is one that has moving parts.

B. Non-Active – A non-active system is one that has no moving parts.

1.4 ACCEPTED STANDARDS

A. ASCE 7-16 Section 13.2.2 requires certification be provided for active mechanical, electrical, and containment and storage equipment that is identified as being assigned to the Designate Seismic System. This designation requires said systems to remain operable and functional following the design earthquake ground motion. Documentation confirming suitability shall be provided as outlined in the Submittal Section.

B. ASCE 7-16 Section 13.1.7 allows for the use of reference documents or standards for industry specific systems or components which represent acceptable procedures for seismic design and construction. The use of these documents or standards does not alleviate the SELLER from submitting calculations, drawings and product data that show conformance to the requirements of this section.

C. Pre-approved details meeting the requirements of ASCE 7-16 Section 13.3 may be used for this project without submitting calculations indicating compliance with the design criteria specified in Section 1.6 Design Criteria. The SELLER shall provide shop drawings detailing the product and specifying the pre-approved detail(s) to be used and their locations along with supporting documentation.

1.5 SUBMITTALS

A. Product data: Illustrate and indicate style, material, strength, fastening provision and finish for each type and size of seismic restraint component used.

B. Shop drawings: Submit shop drawing plans and details indicating horizontal and vertical location (with respect to floor level and grids) layout, spacing, sizes and types of seismic restraint and gravity supports for each system or component requiring bracing. The connection details shall be on similar size plan sheets and clearly presented in the electronic submittal document. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices. Shop drawings shall be stamped by a registered Structural Engineer in the State of Oregon. The shop drawings must be clearly organized and presented such that they can be readily interpreted by the CONTRACTOR for installation and the Special Inspector. Include the following:

1. Fabricated Support: representations of field-fabricated supports not detailed on the Shop Drawings.

2. Seismic Restraints: Detail anchorage and bracing not defined by other details or charts on the Shop Drawings. Include the following:

3. Design: To support selection and arrangement of seismic restraints, include calculations of combined tensile, compressive and shear loads. NOTE: Anchorage to concrete shall comply with ACI 318-19, Chapter 17 assuming cracked concrete conditions.

4. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods and spacing. Identify components, list their strengths and indicate directions and values of forces transmitted to the structure during seismic events.

C. Calculations: Calculations shall be submitted together with the Shop Drawings. Calculations shall substantiate the design of the sizes, thicknesses, and types of seismic-restraint connections, gravity support connections, fabrication, and attachment (fastening, anchorage, welding, etc.) to the structure, including all fasteners. Calculations shall clearly indicate the loads imposed on the primary building structure, including magnitude, direction and location. Calculations shall be based upon the design requirements in Section 1.7 Design Criteria shall be stamped by a registered Structural Engineer in the State of Oregon.

D. Welding certificates of welders performing component or system installation.

E. Field Quality Control Reports

F. Field Observation Reports from the Special Inspector

1.6 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in ASCE 7-16 unless requirements in this Section are more Stringent.

1.7 DESIGN CRITERIA

A. General. Seismic Demands on Non-Structural Components per ASCE 7-16 Section 13.3 are superseded by Sections 1.7.B and 1.7.C below. Conform to all other Sections of ASCE 7-16 Chapter 13.

B. Horizontal seismic forces. Design and detail all members and connections to meet the requirements of ASCE 7-16 based on the actual system or component operating weight. The design and evaluation of components and their support and attachments shall consider their flexibility as well as their strength. The following forces shall be used for all design and calculations.

1. Seismic Design Category: D

2. Risk Category: III

3. F_p = horizontal seismic design force applied in any direction

$$F_p = 0.4\, S_{DS}\, [(a_p W_p)(1+2z/h)]/(R_p/I_p)$$

$$F_{pMAX} = 1.6\, I_p\, S_{DS}\, W_p$$

$$F_{pMIN} = 0.3\, I_p\, S_{DS}\, W_p$$

4. a_p = component amplification factor, per ASCE 7-16 Chapter 13, unless specified elsewhere within individual Specification Divisions or individual Specification Sections

5. R_p = component response modification factor, per ASCE 7-16 unless specified elsewhere for individual Division or Specification Sections

6. W_p = component operating weight

7. Ω_0 = Overstrength Factor, per ASCE 7-16 Chapter 13, unless specified elsewhere within individual Specification Divisions or individual Specification Sections.

8. I_p = 1.5, component importance factor.

9. z = height (in feet) above ground floor for the attachment of the component (see drawings for floor elevations). z shall be taken as zero below grade. The value of z/h need not exceed 1.0.

10. h = roof height above grade.

11. S_{DS} = 0.568, Short Period Design Spectral Response Acceleration

C. Vertical seismic forces. Calculate vertical seismic force by the following equation. The design force shall be applied vertically at the center of gravity of the component or distributed according to the mass distribution of the component or system. The vertical seismic force shall be combined with the horizontal seismic force as well as the Dead Load gravity force to determine the maximum force for component or anchorage design. Combine horizontal and vertical effects as indicated in ASCE 7-16, Section 13.3.1.

$$F_{pV} = +/-0.2\ S_{DS}W_p$$

D. Seismic attachments, bracing and anchorage shall be designed such that the component force is transferred to the lateral force resisting system of the structure through a complete load path. Attachments shall not be made across expansion and contraction joints.

E. Components with vibration isolation systems shall have snubbers in each horizontal direction and vertical restraints as necessary to resist overturning.

F. The seismic anchorage system shall provide restraint in all directions, including vertical, for each component or system for which seismic design is required.

PART 2 PRODUCTS

A. (NOT USED)

PART 3 EXECUTION

A. (NOT USED)

END OF SECTION

SECTION 01 45 00 - QUALITY CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers quality control requirements supplementary to those of the General Conditions and Technical SPECIFICATIONS.

1.2 PROVISIONS

A. CONTRACTOR's Responsibility for Testing

The CONTRACTOR shall be responsible for the cost of all testing as specified in this Section. Additional information has been provided regarding the payment responsibility for the OWNER with regards to the Project.

B. OWNER's Right to Perform Additional Tests

The OWNER or ENGINEER reserves the right to complete additional testing. In such cases, the CONTRACTOR shall provide safe access for the OWNER or ENGINEER and their inspectors to adequately inspect the quality of WORK and the conformance with project SPECIFICATIONS.

1.3 QUALITY ASSURANCE

A. Testing Requirements

An independently owned and operated laboratory approved by the ENGINEER shall perform all testing as specified herein.

B. Testing

1. General

a. All required testing of WORK and/or materials shall be conducted in the presence of the ENGINEER. The CONTRACTOR shall provide 48-hour notification to the OWNER and OWNER's REPRESENTATIVE prior to conducting any and all quality assurance testing. Where applicable, WORK and materials shall only be buried with the consent of the ENGINEER.

b. Where such inspection and testing are to be conducted by an independent laboratory or agency, the sample or samples of material to be tested shall be selected by such laboratory or agency or by the ENGINEER. The CONTRACTOR shall furnish such samples of all materials without charge to OWNER.

c. The results from any and all tests are made for the information of the OWNER. Regardless of any test results, the CONTRACTOR is solely responsible for the quality of workmanship and materials and for compliance with the requirements of the DRAWINGS and SPECIFICATIONS.

2. Costs of Testing

    a. The CONTRACTOR shall be responsible for and shall pay for all tests as specified in Part 3 of this Section. Additional information has been provided regarding the payment responsibility for the OWNER with regards to the Project.

    b. With regards to all materials to be tested, where test results demonstrate that the material or workmanship does not meet the minimum requirements of the Contract Documents, additional testing shall be completed and shall be paid for by the CONTRACTOR with no reimbursement by the OWNER.

1.4 SPECIAL INSPECTIONS

Special inspections and testing as required by Chapter 17 of the IBC shall be conducted by CONTRACTOR-retained Special Inspectors and Testing Agencies as required and as indicated in the Contract Documents.

A. Special Inspectors and Testing Agencies Responsibilities

1. Verify that manufacturers maintain detailed fabrication and quality control procedures and review the completeness and adequacy of those procedures to perform the WORK.

2. Promptly notify OWNER and CONTRACTOR of irregularities and deficiencies observed in the WORK during performance of their services.

3. Submit certified written report of each test, inspection and similar quality control service to OWNER, CONTRACTOR and jurisdictional authorities. Interpret test results and inspections and state in each report whether tested and inspected WORK complies with or deviates from the Contract Documents.

4. Submit final report of special inspections at Substantial Completion, including a list of unresolved deficiencies.

5. Re-test and re-inspect corrected WORK.

B. CONTRACTOR'S Responsibilities

1. Provide quality requirements to all CONTRACTORs and enforce all requirements.

2. Notify OWNER, ENGINEER, Special Inspectors and Testing Agencies at least 48 hours in advance of time when WORK that requires testing or special inspecting will be performed, unless otherwise indicated in the Contract Documents.

3. Pay for any CONTRACTOR requested testing and inspecting not required by the Contract Documents.

4. Pay for any re-testing or re-inspections by Special Inspectors and Testing Agencies for replacement WORK resulting from WORK that failed to comply with the Contract Documents. OWNER will deduct such costs from the Contract Price.

5. Submit copies of licenses, certifications, correspondence, records and similar documents used to establish compliance with standards and regulations that pertain to performance of the WORK to the OWNER, ENGINEER and Special Inspectors.

6. Where Special Inspection requires pre-construction testing for compliance with specified requirements for performance and test methods, comply with the following:

    a. Provide test specimens representative of proposed products and construction in a timely manner with sufficient time for testing and analyzing results to prevent delaying the WORK.

    b. Provide information on configurations of test assemblies, testing procedures and laboratory test records to adequately demonstrate capability of products to comply with performance requirements.

7. Cooperate with Agencies performing required tests, special inspections, and similar quality control services. Notify Agencies in advance of operations to permit assignment of personnel. Provide the following:

    a. Access to the WORK.

    b. Incidental labor, equipment, and materials necessary to facilitate tests and special inspections.

    c. Adequate quantities of representative samples of materials that require testing and inspecting. Assist Agencies in obtaining samples.

    d. Provide facilities for storage and field curing of test samples.

    e. Deliver samples to Testing Agencies.

8. Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and special inspecting.

9. Schedule times for tests, special inspections, obtaining samples, and similar activities. Distribute schedule to OWNER, ENGINEER, Special Inspectors, Testing Agencies, and each party involved in portions of the WORK where tests and special inspections are required.

1.5 SUBMITTALS

A. Laboratory Test or Inspection Reports

Each report shall be signed and certified by the independently owned and operated testing laboratory. Unless otherwise specified, submit three copies of each report to the OWNER or OWNER's REPRESENTATIVE.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 FIELD TESTING SCHEDULE

A. The CONTRACTOR shall complete field testing in accordance with the following schedule. Additional source material testing shall be completed as necessary to establish the basis of field tests. The frequency of testing listed in this schedule lists the minimum number of tests per quantity of WORK completed by the CONTRACTOR. Testing locations to be determined by the ENGINEER.

Material to be Tested	Payment Responsibility for Initial Testing	Minimum Testing Frequency
Structural Backfill	CONTRACTOR	See Article 3.5, Field Quality Control of Section 31 23 23, Fill for further details on testing requirements.
Trench Backfill	CONTRACTOR	See Article 3.16, Field Quality Control of Section 31 23 17, Trenching for further details. A minimum of 2 tests will be required.
Asphalt Concrete	CONTRACTOR	As required when placed. See detailed requirements Section 32 12 16, Asphalt Paving. A total of 2 tests will be provided.
Concrete	CONTRACTOR	As required when placed. See detailed requirements in Article 3.15, Quality Control Testing During Construction of Section 03 11 00, Concrete WORK.
Grout	CONTRACTOR	Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the ENGINEER to ensure continued compliance with SPECIFICATIONS. See detailed requirements in Article 1.6, Quality Assurance of Section 03 60 00, Grouting.

END OF SECTION

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes provisions for temporary protection of trees and other plant life in preparation for site or building excavation WORK.

B. Related Sections:

1. Section 31 23 16 Excavation
2. Section 31 23 17 Trenching

C. This specification shall be applied concurrently and in conjunction with other plant material protection measures herein described and specified.

PART 2 MATERIALS - NOT USED

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect all trees specified on the DRAWINGS for protection prior to construction.

1. Document with written memorandum and photographs any unusual conditions.
2. Submit copies of documentation to ENGINEER prior to beginning WORK.

B. Verify all conditions on the DRAWINGS with actual conditions at Site regarding tree protection prior to any site disturbance.

C. The ENGINEER must be present during demolition of existing conditions occurring within the drip line of trees designated to remain.

D. Notify ENGINEER 24 hours prior to inspections and/or tagging of protected trees.

3.2 PROTECTION

A. Install barricades specified in the DRAWINGS at drip lines of trees designated to remain prior to the commencement of construction.

B. Clearly designate protected trees and clear of any material storage, personnel, or vehicular movement.

C. Provide temporary fencing, barricades, and guards as necessary or required to protect trees designated on the DRAWINGS to remain, from damage above and below grade.

D. Protect root systems of trees and plant life to remain.

1. Protect from damage due to noxious materials in solution caused by runoff or spillage during mixing and placement of construction materials.

2. Protect from flooding, erosion, or excessive wetting resulting from dewatering operations and compaction.

3. Protect against unauthorized cutting, breaking, skinning roots and branches, or bruising bark.

4. Protect from smothering and compaction.

    a. Do not store construction materials or permit vehicles to drive or park within the drip line area of any tree to remain.

5. Protect from dumping of refuse in close proximity.

E. Where cutting is necessary, review conditions with the ENGINEER before proceeding, and comply with directives of ENGINEER.

3.3 EXCAVATION AROUND TREES

A. Excavate within drip lines of trees only where indicated on the DRAWINGS or as directed by ENGINEER.

B. Where trenching for utilities is required within drip lines, tunnel under or around roots by hand excavating.

1. Where possible trench toward trunk of tree and tunnel under central root mass to avoid severing all lateral roots on side of trench.

2. Do not cut main lateral roots or tap roots over 1-inch in diameter.

3. Temporarily support and protect trees from damage until permanently covered with approved backfill.

C. Do not allow exposed roots to dry out before backfill is placed.

1. Provide temporary earth or burlap cover.
2. Water roots daily when exposed and maintain in a moist condition.

D. Backfill roots only upon inspection approval from the ENGINEER.

1. Backfill around root excavations only with clean imported topsoil free from materials deleterious to root growth.

2. Backfill to eliminate voids and compact only by means of manual tamping at root areas.

3. Water sufficiently to settle topsoil and eliminate voids or air pockets around roots.

4. Allow for natural settlement of soil surface and furnish and apply topsoil sufficient to bring to original finish grade after backfill settlement.

E. If during excavation, any condition arises that threatens the survivability of the protected tree, or an unknown condition arises that affects the stability or integrity of the root system, notify the ENGINEER immediately.

3.4 REPAIR AND REPLACEMENT OF DAMAGED TREES

A. In the event of damage to existing trees:

1. Immediately prune limbs smaller than 3-inch caliper or roots smaller than 2-inch caliper to repair trees damaged by construction operations.

2. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees.

3. Any such pruning and/or repairs shall be approved in advance and at completion by ENGINEER.

4. The ENGINEER shall reserve the right, at cost to the CONTRACTOR, to obtain the services of a Certified Consulting Arborist with current membership in the American Society of Consulting Arborists to determine the severity of damage.

5. The CONTRACTOR is responsible for the cost of repairs caused by their actions or by the actions of SUBCONTRACTORs engaged by the CONTRACTOR.

B. Remove and replace dead or damaged trees which are determined by the ENGINEER to be incapable of restoration to normal growth patterns at no additional cost to OWNER.

1. Provide new trees of the same species as those removed or damaged, with size and/or quantity to be determined by ENGINEER.

2. Furnish replacement trees and plant life to the Site and plant, maintain, and warranty as directed by the ENGINEER.

3. If trees are not replaceable with the same species, and size, compensate the OWNER for the replacement cost of the trees based on the evaluation of a Certified Consulting Arborist.

4. The CONTRACTOR is responsible for additional costs of removing damaged trees and labor for planting new specimens.

3.5 DESIGNATED TREE REMOVAL PROCEDURES

A. If designated tree removal is specified by ENGINEER, furnish labor, material, and equipment necessary for removing and/or salvaging existing trees, if necessary, as designated on the DRAWINGS for removal.

1. Verify location and species with ENGINEER prior to removal.

B. Salable logs or timber may be sold to CONTRACTOR's benefit upon notification and prior approval of OWNER. Upon approval, remove salable logs or timber promptly from site.

3.6 GRADING AND FILLING AROUND TREES

A. Maintain existing grade within drip line of trees unless otherwise indicated on the DRAWINGS or directed by the ENGINEER.

3.7 MAINTENANCE OF PROTECTIVE MEASURES

A. Maintain protective measures throughout the construction process. Immediately repair any alteration to protection measures throughout construction process. Repair or reinstall protective measures immediately upon alteration. Monitor protective measures daily.

B. Remove and clear area of debris and fencing, barricades, etc., upon final written approval of ENGINEER.

END OF SECTION

SECTION 01 57 19.11 - TEMPORARY SEWAGE CONTROL AND BYPASS PUMPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for providing temporary bypass pumping and piping equipment to provide continuous conveyance of sewage from multiple pump stations to a collection system during construction activities.

B. Contract Requirements:

1. The existing facilities continuously pump sewage to the OWNER's Water Resource Recovery Facility (WRRF). The functions of the facility shall not be compromised or diminished during the course of the Work, except as specified herein. Plan and prosecute the Work such that operation of the pump station and WRRF is not interrupted.

2. Coordinate with OWNER prior to shut down. Shut down will only be permitted during periods deemed acceptable by OWNER. CONTRACTOR shall provide and operate equipment to pump sewage from the specified structure upstream of the pump station into the force main, establishing a complete bypass of the station.

3. Inadequate conveyance of sewage or temporary bypass pump system malfunctions could potentially result in the spillage or discharge of sewage. State law allows the Department of Environmental Quality to impose civil penalties for violation of a term, condition, or requirement of OWNER's NPDES Permit, including spillage or discharge of sewage.

4. Spillage or discharge of sewage to surface waters or drainage courses is prohibited during construction. Penalties imposed on OWNER as a result of any bypass of this type caused by CONTRACTOR, its employees or SUBCONTRACTORs, and legal fees and other expenses to OWNER resulting directly or indirectly from the bypass shall be borne in full by CONTRACTOR.

5. CONTRACTOR shall be responsible for controlling any and all leakage resulting from or integral to making all temporary and permanent piping connections, and shall provide any and all devices and materials required to control, stop, divert, or dispose of any and all leakage.

6. Temporary force mains shall be pressure tested as specified herein and shall not leak any sewage during the timeframe it is used. Visually inspect the entire length of the force main alignment daily to verify there are no leaks.

6. CONTRACTOR is responsible for planning, scheduling, and sequencing its construction activities to ensure that pumping of sewage can begin in accordance with the schedule outlined in Section 01 12 16 Work Sequence and remains in effect, at all times thereafter uninterrupted, until the complete facility has been accepted by OWNER.

7. Plan and prosecute the Work such that temporary bypass pumping operations can be initiated in accordance with the schedule outlined in Section 01 12 16 Work Sequence.

1.2 RELATED SECTIONS

A. Section 01 12 16 Work Sequence.

1.3 SUBMITTALS

A. Individual Temporary Sewage Control and Bypass Pumping Plan for any planned bypass at the station. Submit each plan a minimum of six weeks prior to the proposed date of temporary pumping and piping activity.

B. Do not construct, install, or place in operation temporary process pumping and piping facilities until ENGINEER has reviewed and approved each planned bypass.

C. Temporary Sewage Control and Bypass Pumping Plan: At a minimum, to include the following:

1. Name, qualifications, and references of the Supplier providing the pumping facilities, including a minimum of three jobs of similar scope and complexity.

2. Description of the pumps to be used, including pump curves and calculation of pumping capacity required.

3. Description of the temporary primary and backup power supply, and estimated fuel consumption for engine-driven pumps and generators.

4. Description of the control equipment, the temporary control panel(s), and the method to be used to operate the pumps.

5. Drawing showing the layout and routing of bypass pumping equipment, piping, and valves with associated sizes and dimensions.

6. Drawing showing the layout and routing of proposed electrical service connections, including conductor types and sizes, conduits, and routing, with associated sizes and dimensions.

7. Drawing showing the layout of the force main. The drawing shall show details of any portions of the force main routing that is installed below grade.

8. Pump maintenance plan describing regular maintenance to be performed while the pumps are in service and the length of the maintenance period when a pump will be out of service.

9. Contingency plan describing steps to be taken if a pump fails and emergency contact phone numbers. Alarms shall be sent to CONTRACTOR and notify OWNER of any and all alarms.

10. Noise levels at minimum and maximum operating speed.

D. Results of field pressure test of temporary piping shall be submitted prior to startup of temporary pumping operation.

1.4 CONTINUITY OF PUMP STATION OPERATION

A. Once initiated, temporary pumping must be kept in operation, except as specified herein, until the new facilities are accepted by OWNER and capable of accepting the sewage.

B. Execute Work in such a way to allow reasonable access to the facilities by OWNER.

C. Coordinate the switch-over from the temporary pumping system to the new facilities with OWNER.

D. Through the use of permanent or temporary pumps, maintain the following minimum pumping ability at all times during construction:

1. South Welches Pump Station Minimum Capacity:

    a. 600 gallons per minute (gpm) at 77 feet total dynamic head (TDH).

2. Golf Club Terrace Pump Station Minimum Capacity:

    a. 145 gallons per minute (gpm)at 56 feet total dynamic head (TDH).

3. 82nd Ave Pump Station Minimum Capacity:

    a. 214 gallons per minute (gpm) at 53 feet total dynamic head (TDH).

4. Sieben Lane Pump Station Minimum Capacity:

    a. 1,180 gallons per minute (gpm) at 87 feet total dynamic head (TDH).

5. Redundancy: Provide onsite, and installed ready operation, a complete redundant backup pump equal to or larger than the largest pump in the system used to provide the specified minimum pumping capacity.

6. Primary Pump: The primary pump in the temporary pumping system shall be an electric pump.

    a. Provide and install a metered temporary electric service connection, approved by the power utility, for powering the temporary primary pumping system.

    b. Alternatively, if a temporary electric connection is not available, provide a diesel engine-driven generator to provide power for the primary electric pump. If this option is utilized, the backup pump must by powered by a separate power source and shall be as specified herein.

7. Backup Pump: A standby pump shall be provided and installed ready for operation in the event of a power failure. The standby backup pump shall provide the minimum capacity as listed above.

8. Noise Standard: Provide critically silenced enclosures on the pumps and build insulated sound walls to limit noise to 60 dBA at 21 feet. The system shall also meet local, State, and OWNER's noise standards for operating in a residential environment if these requirements are more stringent that specified herein.

1.5 DISCHARGING OF SEWAGE TO SURFACE WATERS

A. Any discharge of sewage to surface waters is prohibited.

PART 2 PRODUCTS

2.1 TEMPORARY BYPASS PUMPING EQUIPMENT

A. Provide all temporary bypass pumping equipment necessary to ensure continuous pumping operations during pump station shutdowns.

B. Temporary bypass pumps shall meet the flow and head requirements as specified above. Temporary bypass pumps shall be non-clog sewage pumps.

C. Primary pump shall be an electrically powered dry-prime non-clog sewage pump.

D. Backup Pump shall be one of the two following options:

1. Diesel fueled engine-driven non-clog dry-prime sewage pump.

2. Electrical pump meeting the requirements of the primary pump and powered by a diesel engine-driven generator.

E. Emergency flow pump shall be an electrically powered dry-prime non-clog sewage pump.

F. Temporary pumping equipment shall include a pump control panel to allow the pump station to be automatically operated, unless manually operated by the CONTRACTOR's staff 24 hours per day.

G. Provide all lifting mechanisms required to install, maintain, and remove temporary pumping equipment.

H. Provide auto dialer to automatically notify CONTRACTOR and OWNER upon all alarms. Coordinate alarm programming with OWNER. Provide high level and overflow level floats for the temporary pumping system:

1. High level alarm float shall be set above the primary pump normal level control elevation and shall trigger the backup pump to run and shall also send an alarm via the auto dialer.

2. Overflow float shall be set above the high-level alarm float and shall send an overflow alarm via the auto dialer.

3. Coordinate primary level control and alarm float elevations with the ENGINEER.

2.2 TEMPORARY PIPING

A. Provide temporary piping, valves, and fittings for temporary pumping equipment, using sizes and types shown in the DRAWINGS.

B. Provide pipe and couplings rated for a minimum pressure of 150 pounds per square inch (psi).

2.3 DIESEL EQUIPMENT SPILL CONTAINMENT

A. Secondary spill containment berms shall be provided for all diesel fueled equipment. Spill containment berm shall be made of 40-mil Linear Low-Density Polyethylene material with minimum 12-inch tall aluminum L-Bracket wall supports.

PART 3 EXECUTION

3.1 OPERATION

A. CONTRACTOR shall be responsible for all costs associated with temporary pumping, including temporary electric service, temporary standby power, all electricity usage, and fuel to operate the temporary pumps and controls.

B. Respond to and resolve all alarms from temporary pumping operations. Have personnel available to respond to an alarm within 30 minutes.

C. Ensure temporary bypass pumps are maintained and remain operational 24 hours per day, 7 days per week for the duration of any planned bypass.

D. Notify OWNER immediately in the event of a high level or overflow alarm. OWNER will provide names and telephone numbers of personnel to be contacted by the CONTRACTOR in the case of an alarm or other emergency.

E. The temporary electrical pump shall not be operated at the same time as the proposed permanent pumps. The switchover from temporary pumping systems to permanent pumping system shall be coordinated with the ENGINEER and OWNER. During the switchover, the standby pump system shall be utilized to ensure that the electrical service is not overloaded.

3.2 STAFFING

A. Provide a minimum of one operator for temporary pumping at all times that the pumps are in operation, unless pumps are automatically controlled in accordance with this Section.

3.3 TEMPORARY PIPING

A. Route temporary piping to avoid blocking construction and maintenance equipment access.

B. Route temporary piping to protect existing trees and shrubs.

C. Provide protection for piping and couplings where crossing access points is unavoidable.

3.4 TESTING

A. Prior to operation, pressure test temporary piping to a pressure no less than 150 psi. Submit test results to ENGINEER.

B. Prior to operation, provide a functional test for the complete temporary pumping system including pumps, valves, alarms, telemetry, and redundancy.

END OF SECTION

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SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Equipment electrical characteristics and components.

1.2 PRODUCTS

A. At minimum, comply with specified requirements and reference standards.

B. Specified products define standard of quality, type, function, dimension, appearance, and performance required.

C. Furnish products of qualified manufacturers that are suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm that Manufacturer's production capacity can provide sufficient product, on time, to meet Project requirements.

D. Domestic Products: Except where specified otherwise, domestic products are required and interpreted to mean products mined, manufactured, fabricated, or produced in United States or its territories.

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

F. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products according to Manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products according to Manufacturer's instructions.

B. Store products with seals and labels intact and legible.

C. Store sensitive products in weathertight, climate-controlled enclosures in an environment suitable to product.

D. For exterior storage of fabricated products, place products on sloped supports aboveground.

E. Provide bonded off-Site storage and protection when Site does not permit on-Site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products; use methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Products complying with specified reference standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and complying with Specifications; no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit Request for Substitution for any manufacturer not named, according to Section 01 33 00 – Submittal Procedures.

PART 2 PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Include lugs for terminal box.

B. Cord and Plug: Furnish minimum 6-foot (2-m) long cord and plug including grounding connector for connection to electric wiring system. Cord of longer length may be specified in individual Specification Sections.

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 75 16 - TESTING, TRAINING AND SYSTEM START-UP

PART 1 GENERAL

1.1 SCOPE

This Section specifies equipment and system testing and start-up, services of manufacturer's representatives, training of OWNER's personnel and final testing requirements for the complete facility.

1.2 CONTRACT REQUIREMENTS

A. Testing, training and facility startup acceptance are requisite to the satisfactory completion of the Contract.

B. Complete all startup procedures, testing and training, as specified herein, within the Contract Time(s).

C. Furnish all necessary labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.

D. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation, testing, and operator training.

1.3 SUBMITTALS

A. Provide detailed Start-up Progress Schedule with the following activities identified:

1. Manufacturer’s services
2. Installation certifications
3. Operator training
4. Submission of operation and maintenance manual
5. Field testing
6. Functional testing
7. Operational testing

B. Testing and Startup Plan:

1. Not less than 30 Days prior to performing field testing, the CONTRACTOR shall submit for review a detailed Testing Plan. The Plan shall include schedules for equipment certifications, schedules for submitting final Operations and Maintenance Manuals, schedule for training the OWNER’s personnel, list of OWNER furnished supplies or equipment, electrical testing schedule, and detailed schedule of operations to achieve successful field testing, functional acceptance testing and activities to implement the operational test.

2. The Plan shall include test checklists and data forms for each item of equipment and shall address coordination with the OWNER’s staff.

3. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

C. The CONTRACTOR shall maintain the following records during installation, field testing, functional acceptance testing and operational readiness testing and submit these said records as requested by OWNER's Representative and shall be provided prior to startup acceptance:

1. Lubrication and service records for each item of mechanical/electrical equipment including logs of time spent by manufacturer's representatives performing services on the job site.

2. Hours of daily operation for each item of mechanical/electrical equipment.

3. Daily logs of equipment testing identifying all tests conducted and outcome.

4. Instrumentation calibration and testing and check lists.

5. Manufacturer's certification of proper equipment installation.

6. Testing and validation of all control inputs, outputs, logic functions, status indication, and alarms.

7. Factory and field equipment settings.

8. Equipment lubrication records, as may be needed.

9. Electrical phase, voltage, and amperage measurements.

10. Insulation resistance measurements.

11. Data sheets of control loop testing including testing and calibration of instrumentation devices and set-points.

12. Field test reports.

13. Functional acceptance test report.

14. Other records, logs, and check lists as required by the Contract Documents.

D. Provide summary of shutdown requirements for existing systems if required, which are necessary to complete start-up of new equipment and systems.

1.4 EQUIPMENT INSTALLATION

A. Inspect all equipment and systems following installation and prior to testing.

B. Provide written certification that mechanical, electrical and instrumentation systems furnished are installed to manufacturer requirements prior to testing.

1.5 FIELD TESTING PROCEDURES

A. Mechanical Systems:

1. Remove rust preventatives and oils applied to protect equipment during construction.

2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.

3. Flush fuel system and provide fuel for testing and start-up.

4. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.

5. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.

6. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.

7. Perform cold alignment and hot alignment to manufacturer's tolerances.

8. Adjust V-belt tension and variable pitch sheaves.

9. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to ensure no leakage but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.

10. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.

11. Install gratings, safety chains, handrails, shaft guards and sidewalks prior to operational testing.

12. Pressure test lift station piping per the specification requirements.

B. Electrical Systems

1. Perform insulation resistance tests on wiring except 120-volt lighting, wiring, and control wiring inside electrical panels.

2. Perform continuity tests on grounding systems.

3. Test and set switchgear and circuit breaker relays for proper operation.

4. Check motors for actual full load amperage draw. Compare to nameplate value.

5. Perform additional testing procedures as required by NEC, other codes, and Division 26 of these SPECIFICATIONS.

6. Document and provide any adjusted equipment settings in the O&M manuals. This shall include all VFD parameter settings.

C. Instrumentation Systems

1. Bench or field calibrate instruments and make required adjustments and control point settings.

2. Energize transmitting and control signal systems, verify proper operation, ranges and settings.

3. Perform additional testing procedures as required by Division 26 and 40 of these SPECIFICATIONS.

4. Document and provide any adjusted equipment settings in the O&M manuals.

D. HVAC SYSTEMS

1. Leak test piping and ducting.
2. Test all electrical and mechanical components for proper operation.
3. Document and provide any adjusted equipment settings in the O&M manuals.

1.1 FUNCTIONAL TESTING

A. Functionally test mechanical and electrical equipment for proper operation after field testing tasks have been completed.

B. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.

C. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

1.2 FUNCTIONAL ACCEPTANCE TEST REPORT

A. At completion of functional testing, the CONTRACTOR shall furnish a written report prepared and signed by manufacturer's authorized representative, certifying equipment:

1. Has been properly installed, aligned, adjusted and lubricated.

2. Is free of any stresses imposed by connecting piping or anchor bolts.

3. Is suitable for satisfactory full-time operation under full load conditions.

4. Operates within the allowable limits for vibration.

5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.

6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly functioning.

B. Furnish written report prepared and signed by the electrical and/or instrumentation SUBCONTRACTOR certifying:

1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation SUBCONTRACTOR has been calibrated and tested and is properly operating.

2. Control logic for equipment start-up, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating.

C. Co-sign the reports along with the manufacturer's representative and SUBCONTRACTORs.

1.3 TRAINING OF OWNER'S PERSONNEL

A. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment per pump station site. Utilize manufacturer's representatives to conduct training sessions.

B. Coordinate training schedule with OWNER's staff. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than two (2) sessions per week.

C. Provide Operation and Maintenance Manual for specific pieces of equipment or systems two (2) weeks prior to training session for that piece of equipment or system.

D. Satisfactorily complete functional testing before beginning operator training.

E. The OWNER may videotape the training for later use with the OWNER's personnel.

1.4 MINIMUM SERVICE SCHEDULE

Minimum services shall be provided by the manufacturers' representatives for certain CONTRACTOR-provided equipment for each pump station site in accordance with the following schedule:

Specification Section	Equipment	1 Equipment Installation Instruction	2 Equipment Testing Assistance	3 Operator Training
43 21 39	Submersible Pumps	1 CWD	1 CWD	1 CWD
26 29 23	Variable Frequency Drive	1 CWD	1 CWD	1 CWD
40 92 00	Programmable Logic Computer	0.5 CWD	1 CWD	0.5 CWD
40 91 00	Level Sensors	0.5 CWD	0.25 CWD	0.25 CWD
40 91 23	Flow Process Measurement	0.5 CWD	0.5 CWD	0.25 CWD
23 05 93	HVAC	0.25 CWD	0.25 CWD	0.25 CWD

NOTE: CWD is defined as a consecutive working day consisting of 8 hours each from 8:00 a.m. to 5:00 p.m.

1.5 OPERATIONAL TESTING

A. Following operator training and functional testing, conduct operational test of the entire facility. Demonstrate satisfactory operation of equipment and systems in actual operation.

B. The operational readiness test shall not be commenced until all required equipment tests have been completed to the satisfaction of the ENGINEER

1. Operational Test

2. The Contractor shall conduct entire facility operational test for continuous 7-day period without malfunctions or deficiencies causing shutdown or partial operation of the facility or results in performance that is less than specified.

3. Operational test shall use clean potable water to test the functionality of the facility for the first 4-days. Contractor shall provide a minimum of 150 gpm of clean water or sewage during this period.

    a. The wet well should be filled with water from the Contractor installed hydrant or sewage from the influent sewer may be used if no water source is available on site for initial testing. The bypass port can be utilized with temporary install piping to convey flow to the bypass manhole so that the wet well does not need to be continuously filled with fresh water and the water or sewage can be recirculated. Contractor to restrain all temporary piping as required.

    b. The purpose of this testing is to completely test the pumps and controls in manual and automatic operational modes, prior to introducing sewage to the new facility.

4. After successful completion of the first 4-days of the 7-day operational test, raw sewage can be conveyed to the wet well to continue the operational test of the facility. See section 01 12 16-Work Sequence for more information.

5. The pump station shall be bypassed during the entirety of the first 4-days of the operational test. The bypassing equipment must remain on-site as a standy during the last 3-days of the operational test.

6. All equipment must properly run continuously 24 hours per day for the test period and within the design criteria range. If any item malfunctions during the test, the item shall be repaired, and the test restarted at day zero with no credit given for the operating time before the aforementioned malfunction.

7. The Contractor shall provide the services of authorized representatives to correct faulty equipment.

8. Contractor shall facilitate hydraulic pump testing by the Engineer during the operational test.

9. All equipment must properly run continuously 24 hours per day for the test period and within the design criteria range. If any item malfunctions during the test, the item shall be repaired, and the test restarted at day zero with no credit given for the operating time before the aforementioned malfunction.

10. The CONTRACTOR shall provide the services of authorized representatives to correct faulty equipment.

11. CONTRACTOR shall facilitate hydraulic pump testing by the ENGINEER during the operational test.

12. CONTRACTOR shall provide any bypassing necessary as part of the testing procedures.

C. The CONTRACTOR shall provide operating personnel for the duration of the operational test.

D. CONTRACTOR shall provide power, fuel, and other consumables for duration of the operational test.

E. Immediately correct defects in material, workmanship, or equipment which became evident during operational test.

1.6 PUMP STATION STARTUP ACCEPTANCE

A. Pump station startup acceptance will be provided to the CONTRACTOR by the ENGINEER when the following activities are approved by the ENGINEER:

1. Successful completion of the 7-day operational test.
2. All records specified in Section 1.3.C of this Specification are provided to the ENGINEER.
3. All manufacturer training of OWNER personnel is complete.

B. Pump station startup acceptance does not relieve the CONTRACTOR of the requirements for final acceptance as specified in the General Requirements.

1.7 RECORD KEEPING

A. Maintain and submit to ENGINEER the following records generated during start-up and testing phase of project:

1. Daily logs of equipment testing identifying all tests conducted and outcome.

2. Logs of time spent by manufacturer's representatives performing services on the job site.

3. Equipment lubrication records.

4. Electrical phase, voltage, and amperage measurements.

5. Insulation resistance measurements.

6. Pump torsional and lateral vibration analysis report.

7. Data sheets of control loop testing including testing and calibration of instrumentation devices and set-points.

END OF SECTION

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SECTION 02 41 00 - DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of existing facilities.
2. Abandoning and removing utilities.

B. Related Sections:

1. Section 31 05 16 - Aggregates for Earthwork
2. Section 31 10 00 - Site Clearing – NOT USED
3. Section 31 22 13 - Rough Grading – NOT USED
4. Section 31 23 16 - Excavation
5. Section 33 11 50 - Existing Pipe Abandonment

1.2 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Submit to ENGINEER a copy of written permission of private property OWNERs, with copy of fill permit for said private property, as may be required for disposal of materials.

1.3 QUALITY ASSURANCE

A. Existing Conditions: Determine the extent of WORK required and limitations before proceeding with WORK.

B. Conform to applicable local, state, and federal codes for environmental requirements in relation to disposal of debris.

1. Burning at the Site for the disposal of refuse, debris, and waste materials resulting from demolition and site clearing operations shall not be permitted.

C. Permits: The CONTRACTOR is responsible for obtaining all necessary permits required for completion of the WORK described in this Section.

D. Protection of Persons and Property: Meet all federal, state, and local safety requirements for the protection of workmen, other persons, and property in the vicinity of the WORK and requirements of the General Provisions.

E. If the existing material to be demolished and removed contains any hazardous materials which will require special handling upon removal, such as asbestos or lead, it is the responsibility of the CONTRACTOR to remove and dispose of the material in accordance with all applicable federal, state and local regulations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Existing Materials: All materials, equipment, miscellaneous items, and debris involved, occurring, or resulting from demolition, clearing, and grubbing work shall become the property of the CONTRACTOR at the place of origin, except as otherwise indicated in the DRAWINGS or SPECIFICATIONS.

B. Crushed Rock: As specified in Section 31 05 16-2.1, Aggregates for Earthwork. Of the size shown in the DRAWINGS or specified herein.

C. Sand: As specified in Section 31 05 16-2.2, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. The OWNER assumes no responsibility for the actual condition of the facilities to be demolished. The CONTRACTOR shall visit the site, inspect all facilities and be familiar with all existing conditions and utilities.

B. Demolition drawings identify major equipment and structures to be demolished only. Auxiliary utilities such as water, air, chemicals, drainage, lubrication oil, hydraulic power fluid, electrical wiring, controls, and instrumentation are not necessarily shown shall be considered incidental to all demolition work.

C. Identify waste and salvage areas for placing removed materials.

3.2 PREPARATION

A. Carefully coordinate the WORK of this Section with all other WORK and construction.

B. Call Local Utility Line Information service at 811, not less than three working days before performing WORK.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Disconnect or arrange for disconnection of utilities (if any) affected by required WORK.

3. Keep all active utilities intact and in continuous operations.

3.3 PROTECTION

A. Utilities: Locate, identify, and protect utilities located by utilities and indicated in the DRAWINGS to remain from damage.

B. Survey control: Protect benchmarks, survey control points, and existing structures from damage or displacement.

C. Miscellaneous Site Features: Protect all existing miscellaneous site features from damage by excavating equipment and vehicular traffic, including but not limited to existing structures, fences, mailboxes, sidewalks, paving, guy wires, utility poles, and curbs.

D. Repair and Replacement:

1. Damaged items, including but not restricted to those noted above, shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of WORK of this contract.

2. Any damage to existing facilities or utilities to remain as caused by the CONTRACTOR's operations shall be repaired at the CONTRACTOR's expense.

3.4 DEMOLITION

A. Carefully consider all bearing loads and capacities for placement of equipment and material on site. In the event of any questions as to whether an area to be loaded has adequate bearing capacity, consult with ENGINEER prior to the placement of such equipment or material.

B. Demolition of Existing Structures:

1. Excavate around existing structures as required to perform demolition operations and to plug associated existing pipelines where shown in the Drawing.

2. Provide shoring, bracing, and supports, as required, to ensure adjacent structures are not damaged and structural elements of existing structure are not overloaded during demolition activities.

a. Increase structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract.

b. Remove all temporary protection when the WORK is complete or when so authorized by the ENGINEER.

3. Any floors that are to remain in place shall be completely cracked through to allow for drainage. Cracking shall be accomplished by dropping a demolition ball or by other methods approved by the ENGINEER.

4. Remove and dispose of all exposed and/or protruding metalwork, piping, plumbing, and conduits resulting from demolition activities, and all woodwork, roofing, and electrical and mechanical equipment removed from demolished structures.

a. Reinforcing bars shall be cut flush with final wall elevations as shown in the DRAWINGS.

b. No detached metalwork, excluding concrete reinforcing bars, shall be buried with the concrete and masonry rubble.

C. Backfill at Demolished Structures:

1. For structures designated to be abandoned and/or demolished in place, concrete and/or masonry rubble and excavated soils resulting from demolition activities shall be used for backfill or placed in the bottoms of said structures only as directed by the ENGINEER.

2. Concrete and masonry rubble used for backfilling shall be broken into pieces no larger than 12 inches on any one side.

3. Materials resulting from abandonment/demolition activities approved for backfill shall be combined with imported filler sand to create a dense, compacted backfill.

4. Backfilling or placement of the excavated material in the structures shall meet the following requirements.

    a. Furnish, place and compact filler sand along with the concrete and masonry rubble so that all voids are filled and a dense, compacted backfill is obtained.

    b. Filler sand shall be placed in horizontal layers completely filling all voids between pieces of rubble and not exceeding 12 inches in thickness.

    c. Each layer of filler sand shall be compacted to obtain at least 90 percent of maximum density as determined by ASTM Method D-698-78 (AASHTO T-99).

    d. Water shall be furnished by the CONTRACTOR and added to each layer as required to maintain optimum moisture content.

    e. The amount of filler sand used shall only be the amount needed to fill all voids created by placement of the concrete and asphalt rubble, as directed by the ENGINEER.

    f. At locations where concrete and masonry rubble are used for backfill, they shall be placed such that a minimum of 3 feet of compacted non-rubble backfill material (crushed rock) exists between any rubble and finished grade. Protruding reinforcing bars shall be cut to lengths that allow granular backfill to be placed and compacted to required levels in and above the rubble.

5. Disposal of all materials not used for backfill shall be performed off-site and in compliance with applicable local, state, and federal codes and requirements.

6. In areas where new construction will take place, no trace of these structures shall remain prior to placing of backfill.

D. Backfilling within the footprint of new structures with rubble material resulting from demolition activities will not be allowed.

E. All existing improvements designated in the DRAWINGS or specified to be removed, including but not limited to structures, pipelines, walls, footings, foundations, slabs, pavements, curbs, fencing, and similar structures occurring above, at, or below existing ground surface shall be included in the demolition work.

F. Unless otherwise specified, any resulting voids shall be backfilled with suitable excavated or imported material compacted to the density of the adjacent soil.

3.5 EXISTING UTILITY PIPING ABANDONMENT

A. As specified in Section 33 11 50, Existing Pipe Abandonment.

3.6 ELECTRICAL AND CONTROL SYSTEM DEMOLITION

A. All electrical and control system demolition work shall at all times be conducted in a safe and proper manner to avoid injury from electrical shock to all personnel.

1. Electrical equipment to be shut off for a period of time shall be tagged, locked out, and sealed with a crimped wire and lead seal and made inoperable.

2. At no time shall live electrical wiring or connections or those which can become energized be accessible to any persons without suitable protection or warning signs.

3.7 PERMANENT ABANDONMENT OF WELLS

A. The Contractor shall permanently abandon wells where noted on the Plans.

B. The Contractor shall be responsible for securing and paying any local, state, or federal fees for abandonment of the well.

C. Abandonment of the well shall be performed by a licensed well constructor in the state in which the work is accomplished.

D. All work shall be performed according to federal, state, and local standards for permanent well abandonment.

3.8 ASPHALTIC CONCRETE DEMOLITION

A. Asphalt pavement shall be removed to the limits shown in the DRAWINGS.

B. The limits of the removal shall be saw cut.

C. Asphalt pavement may not be used as rubble fill.

3.9 REMOVAL

A. Remove debris, rock, excavated materials, rubble, abandoned piping, and extracted plant life resulting from abandonment and/or demolition activities from site.

B. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

C. Removal: All material resulting from demolition, clearing, and grubbing, and trimming operations shall be removed from the project site and disposed of in a lawful manner. Materials placed on property of private property OWNERs shall be by written permission only.

3.10 GRADING

A. All grading work shall be completed in accordance with Section 31 22 13, Rough Grading.

3.11 CLEANUP:

A. During and upon completion of WORK, promptly remove all unused tools and equipment, surplus materials, debris, and dust and shall leave all areas affected by the WORK in a clean, condition, as may be subject to ENGINEER approval.

B. Adjacent structures shall be cleaned of dust, dirt, and debris resulting from demolition.

C. Adjacent areas shall be returned to their existing condition prior to the start of WORK.

3.12 EQUIPMENT AND MATERIALS SALVAGE SCHEDULES

A. Salvage and deliver materials and equipment included below or shown on the Plan to the Tri-City WRRF located 15941 S Agnes Ave, Oregon City, OR 97045.

B. Unless otherwise specified or noted on the Plans salvage all working air compressors used for bubbler control systems.

END OF SECTION

SECTION 03 01 30.71.11 - CONCRETE REHABILITATION

PART 1 GENERAL

1.1 DESCRIPTION

A. This section specifies concrete rehabilitation work below grade concrete structures such as wet wells and valves vaults.

B. The scope of work includes the following:

1. Concrete rehabilitation

   Inspect in field and rehabilitate areas of damaged concrete surfaces with concrete rehabilitation mortar system specified herein.

1.2 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

A. Codes and Standards -- Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. ACI 301 “Specifications for Structural Concrete for Buildings”
2. ACI 311 “Recommended Practice for Concrete Inspection”
3. ACI 318 “Building Code Requirements for Reinforced Concrete”
4. ACI 347 “Recommended Practice for Concrete Formwork”
5. ACI 304 “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete”
6. ACI 503.4-92 “Standard Specifications for Repairing Concrete with Epoxy Mortars”
7. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”

B. Comply with building code requirements which are more stringent than the above and all OSHA requirements.

C. Related Sections:

1. 03 64 24 - Epoxy Adhesive Injection of Concrete Members – NOT USED
2. 09 90 00 - Painting and Coating

1.3 ACCEPTABLE CONCRETE REHABILITATION CONTRACTORS

A. Concrete Rehabilitation Contractors

The ENGINEER shall approve all concrete rehabilitation contractors for concrete rehabilitation and interior surface coating work. If concrete rehabilitation contractors are not listed within the prequalification list below, a Request for Qualification shall be submitted during submittal

review. Potential qualified concrete rehabilitation contractors for this project are as follows:

1. ConTech Services, Inc.

B. Due to the specialty nature of concrete rehabilitation work, the concrete rehabilitation contractors shall be qualified by the ENGINEER. If the concrete rehabilitation contractor is not listed above, a Request for Qualification shall be submitted during the submittal process. The concrete rehabilitation contractor shall have a minimum of five (5) consecutive years of practical experience and successful history in the application of the specified materials herein. The Request for Qualification shall consist of the following:

1. A letter signed by the concrete rehabilitation contractor that states the qualifications of the firm for accomplishing the specified concrete rehabilitation work.

2. A list of similar projects completed within the last five years. The list shall include the name of the project, the date completed, the project engineer, and the name of the owner (include the owner's address, phone number and contact person).

3. Certifications and experience resumes of individual installers and field supervisor(s) to be appointed to the project.

   Each Request for Qualification will be evaluated on the basis of the contractor's demonstrated experience on similar projects and his or her ability to demonstrate full compliance with the DRAWINGS and SPECIFICATIONS. The contractor must present evidence that the key installers and supervisory personnel are qualified for the type of products specified and that they have practical experience in the successful rehabilitation of at least three (3) similar projects.

1.4 CONTRACTOR SUBMITTALS

A. Materials List -- The CONTRACTOR shall provide a materials list for all concrete rehabilitation materials which indicates the manufacturer and identifies which rehabilitation system the material corresponds with.

B. Manufacturers and Applicator Information -- For each rehabilitation to be used the CONTRACTOR shall submit the following listed data.

1. Manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

2. Manufacturer's instructions and recommendations on surface preparation and application.

3. Colors available for each product and each coat.

4. Material safety data sheet (MSDS) for each product used.

5. The name of the proposed concrete rehabilitation contractor along with completed Request for Qualification as specified above.

6. Certificate -- Submit manufacturer's certificate of compliance with the SPECIFICATIONS and standards signed by a representative in the manufacturer's employ.

1.5 DELIVERY, STORAGE, AND HANDLING

A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.

B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.

C. Condition the specified product as recommended by the manufacturer.

1.6 JOB CONDITIONS

A. Environmental Conditions: Ambient and substrate temperatures at time of application shall be in accordance with manufacturer's specifications.

B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of a specified coating or mortar.

1.7 WARRANTY

A. Provide a written warranty from the manufacturer against defects of materials for a period of five (5) years, beginning with date of substantial completion of the project. This warranty shall be a material and labor warranty from the manufacturer covering both material and labor in the event of product failure within the specified warranty period.

1.8 SAFETY AND HEALTH REQUIREMENTS

A. Ventilation, electrical grounding, and care in handling concrete rehabilitation materials and equipment are important safety precautions during concrete rehabilitation projects. CONTRACTOR shall conform with safety requirements set forth by regulatory agencies applicable to the construction industry and manufacturer's printed instructions and appropriate technical bulletins and manuals. The CONTRACTOR shall provide and require use of personal protective life-saving equipment for persons working in or about the project site.

B. All ladders, scaffolding and rigging shall be designed for their intended uses. Ladders and scaffolding shall be erected where requested by ENGINEER to facilitate inspection and be moved by the CONTRACTOR to locations requested by the ENGINEER.

C. Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Ventilation shall reduce the concentration of air contaminant to the degree a hazard does not exist by ducting air, vapors, etc. from the confined space. Air circulation and exhausting of solvent vapors shall be continued until concrete rehabilitation materials have fully cured.

D. Illumination: Spark proof artificial lighting shall be provided for all work in confined spaces. Light bulbs shall be guarded to prevent breakage. Lighting fixtures and flexible cords shall comply with the requirements of NFPA 70 "National Electric Code" for the atmosphere in which they will be used. Whenever required by the ENGINEER, the CONTRACTOR shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the ENGINEER.

E. The CONTRACTOR shall comply with all applicable Oregon OSHA, EPA, and DEQ regulations relating to surface preparation, application and all associated activities.

1.9 QUALITY ASSURANCE

A. Workmanship -- The CONTRACTOR is responsible for correction of concrete rehabilitation work that does not conform to the specified requirements, including strength, tolerances, and finishes. Correct deficient concrete as directed by the ENGINEER. The CONTRACTOR shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

B. Materials and installed work may require testing and retesting, as directed by the ENGINEER, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. All testing, including the retesting of rejected materials and installed work shall be done at the CONTRACTOR's expense.

C. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

D. The concrete rehabilitation systems material manufacturer's representative shall make periodic site visits throughout the course of concrete rehabilitation, surface preparation and application of the work. The concrete rehabilitation material manufacturer's representative shall schedule all site visits with the ENGINEER and shall prepare and submit written reports to the ENGINEER directly following each site visit. This report shall identify the representative's observations relative to the quality of concrete rehabilitation work and shall address any conditions observed which have the potential to adversely impact the finished system's integrity and performance. Any such findings shall be immediately remedied by the CONTRACTOR.

The above-described service of the concrete rehabilitation material manufacturer's representative shall be provided at no additional expense to the OWNER. The reports of the manufacturer's representative shall not preclude the ENGINEER from making independent assessments of the quality of work. The ENGINEER will make the final decision as to the acceptability of the concrete rehabilitation system.

E. The CONTRACTOR shall provide all instruments required for testing atmospheric conditions and shall, during concrete rehabilitation operations, perform all required measurements in the company of the ENGINEER. As a minimum, the CONTRACTOR shall measure and record temperature and relative humidity daily prior to beginning any application of concrete rehabilitation. Records shall be maintained on forms approved by the ENGINEER.

F. CONTRACTOR shall furnish, until final acceptance of concrete rehabilitation systems, inspection devices in good working condition as required for monitoring moisture content and/or temperature and all other parameters as required by the manufacturer. Inspection devices shall be operated by or in the presence of the ENGINEER with location and frequency basis determined by the ENGINEER. The ENGINEER is not precluded from furnishing his own inspection devices and rendering decisions based solely on their tests.

PART 2 PRODUCTS

2.1 GENERAL

A. Definitions -- The terms "concrete rehabilitation materials" or "mortars" as used herein, shall include surface treatments, epoxy resins, rehabilitation mortars and all concrete rehabilitation materials whether used as a pretreatment or primer.

B. General -- Concrete rehabilitation materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, date of manufacture, expiration date, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.

C. The CONTRACTOR shall use concrete rehabilitation materials suitable for the intended use and recommended by their manufacturer for the intended service.

D. Compatibility -- In any concrete rehabilitation system only compatible materials from a single manufacturer shall be used in the work unless approved by the ENGINEER. Attention shall be directed to compatibility of primers or corrosion inhibitors and finish coats or mortars.

E. Concrete Rehabilitation Materials -- Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the CONTRACTOR shall provide the ENGINEER with the names of not less than 10 successful applications of the proposed manufacturer's products demonstrating compliance with this specification requirement.

F. Substitute or "Or-Equal" Submittals -- Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the concrete rehabilitation materials of the companies listed. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or equal" material that said material meets the specified requirements and is equivalent or better than the listed materials. If the proposed substitution requires changes in the contract work, the CONTRACTOR shall bear all such costs involved and the costs of allied trades affected by the substitution.

G. The cost of all equipment used in testing and analyzing of the concrete rehabilitation materials that may be required by the ENGINEER shall be paid by the CONTRACTOR.

2.2 CONCRETE REHABILITATION SYSTEMS

A. General

Provide and apply the concrete rehabilitation systems that follow as listed in the concrete rehabilitation system schedule herein, as required by these SPECIFICATIONS and as directed by the ENGINEER.

B. Rehabilitation Mortar System

1. Location - All eroded, and spalled concrete and shotcrete surfaces and areas with exposed reinforced steel.

2. Surface preparation – As specified herein.

3. System - Apply a corrosion inhibitor/primer/bonding agent to all exposed rebar and other steel components and to concrete surfaces to be rehabilitated per manufacturer's requirements. Apply a polymer-modified, cement-based, rehabilitation mortar, trowel applied as specified by the manufacturer.

C. Approved Epoxy Mortars

1. Concresive Standard Paste LPL
2. Contech Services KonTek K-122 LPP

PART 3 EXECUTION

3.1 STORAGE AND MIXING OF MATERIALS

A. Manufacturer's Recommendations -- Unless otherwise specified herein, the concrete rehabilitation manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its materials, for preparation of surfaces, and for all other procedures relative to the work specified herein shall be strictly observed.

B. All materials shall be used within the manufacturer's recommended shelf life.

3.2 SURFACE PREPARATION

A. General

All surfaces to be rehabilitated shall be prepared as specified by the concrete rehabilitation manufacturer.

B. Concrete Preparation

1. Concrete - Mechanically remove all loose concrete as required to expose sound aggregate. Clean concrete surfaces to achieve a contaminate-free, open textured surface. Square cut or under cut perimeter to minimum depth as specified by the rehabilitation mortar manufacturer.

2. Reinforcing Steel - Remove all loose concrete around the exposed steel and hand tool or blast clean all portions of rebar with visible rust to near white metal finish. If half of the diameter of the reinforcing steel is exposed, chip out behind the reinforcing steel to a 1/2-inch minimum depth. Splice new reinforcing steel to existing where corrosion has depleted the cross-section area by 25%.

3.3 APPLICATION

A. All concrete rehabilitation materials shall be applied as specified by the concrete rehabilitation material manufacturer.

3.4 CORRECTIONS AND CLEAN-UP

A. Mortar System

1. Uncured materials can be cleaned from tools with water. Cured materials may need to be removed mechanically.

2. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION

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SECTION 03 11 00 - CONCRETE WORK

PART 1 GENERAL

1.1 SUMMARY

A. The extent of concrete work is shown on the DRAWINGS.

B. Work includes providing formwork and shoring for cast-in-place concrete and installation into formwork of items such as reinforcing steel bar (rebar), anchor bolts, setting plates, bearing plates, anchorages, inserts, reveals, frames, nosings, sleeves and other items to be embedded in concrete.

1.2 QUALITY ASSURANCE

A. Codes and Standards

Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified here:

ACI 301 "Specifications for Structural Concrete for Buildings"

ACI 311 "Recommended Practice for Concrete Inspection"

ACI 318 "Building Code Requirements for Reinforced Concrete"

ACI 347 "Recommended Practice for Concrete Formwork"

ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"

Concrete Reinforcing Steel Institute, "Manual of Standard Practice"

Comply with building code requirements which are more stringent than the above and all Occupational Safety and Health Administration (OSHA) requirements.

B. ASTM International (ASTM)

1. C31, Making and Curing Concrete Test Specimens in the Field
2. C33, Specification for Concrete Aggregate
3. C39, Compressive Strength of Cylindrical Concrete Specimens
4. C40, Organic Impurities in Fine Aggregate for Concrete
5. C85, Cement Content of Hardened Portland Cement Concrete
6. C88, Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate
7. C94, Standard Specifications for Ready-Mixed Concrete

8. C131, Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
9. C136, Method for Sieve Analysis to Fine and Coarse Aggregate
10. C143, Slump of Portland Cement Concrete
11. C150, Standard Specification for Portland Cement
12. C156, Water Retention by Concrete Curing Materials
13. C173, Air Content of Freshly Mixed Concrete by the Volumetric Method
14. C231, Air Content of Freshly Mixed Concrete by the Pressure Method
15. C233, Standard Method of Testing Air-Entraining Admixtures for Concrete
16. C260, Standard Specifications for Air-Entraining Admixtures for Concrete
17. C289, Standard Test Method for Potential Reactivity of Aggregates (Chemical Method)
18. C441, Standard Test Method for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to the Alkali-Aggregate Reaction
19. C457, Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete
20. C494, Standard Specifications for Chemical Admixtures for Concrete
21. C670, Preparing Precision Statements for Test Methods for Construction Materials
22. C803, Penetration Resistance of Hardened Concrete

C. Workmanship

The CONTRACTOR is responsible for correction of concrete work that does not conform to the specified requirements, including strength, tolerances, and finishes. Correct deficient concrete as directed by the ENGINEER. The CONTRACTOR shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

D. Concrete Testing Service

The CONTRACTOR shall engage a special inspector/testing laboratory to perform material evaluation tests and to design concrete mixes. See detailed requirements in Part 3.14 “Quality Control Testing during Construction”. Per the OWNER or ENGINEER’s requirements the CONTRACTOR shall notify the designated representative to schedule the special inspections and materials testing required by the project documents.

E. Testing Requirements

Materials and installed work may require testing and retesting, as directed by the ENGINEER, at any time during the progress of the work. Allow free access to material stockpiles and

facilities at all times. All testing, including the retesting of rejected materials and installed work shall be done in accordance with specification 01 45 00 Quality Control.

F. Tests for Concrete Materials

1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the methods of test of ASTM C150.

3. Submit written reports to the ENGINEER, for each material sampled and tested prior to the start of work. Provide the project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

4. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing. The materials producer and the CONTRACTOR must sign certificates of compliance.

G. Allowable Tolerances:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:

a. Variation from plumb in lines and surfaces of columns, piers, walls and rises; 1/4-inch per 10 feet, but not more than 1-inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum; 1/2-inch maximum in 40 feet or more.

b. Variation from level or grade in slab soffits, ceilings, beam soffits, and rises 1/4-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum, and 3/4-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum and 1/2-inch in 40 feet or more.

c. Variation from position of the linear lines and related columns, walls, and partitions, 1/2-inch in any bay or 20 feet maximum, and 1-inch in 40 feet or more.

d. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4-inch.

e. Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls, minus 1/4-inch and plus 1/2-inch.

f. Variations in footing plan dimensions, minus 1/2-inch and plus 2 inches; misplacement or eccentricity, 2 percent of the footing width in direction of misplacement but not more than 2 inches; thickness reduction, minus 5 percent.

g. Variation in steps - In a flight of stairs, 1/8-inch for rise and 1/4-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.

h. Circular structures shall be constructed in a true circular form, with maximum variation of 1/4-inch from the dimensions shown on the plans.

2. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

3. During concrete placement check formwork and related supports to ensure that forms are not displaced, and that completed work will be within specified tolerances.

H. Quality Control Testing During Construction

See Section 3 - Execution.

1.3 SUBMITTALS

A. For information only, submit six copies of manufacturer's data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water stops, joint systems, chemical floor hardeners, dry-shake finish materials, and others. Bind and submit in one submittal.

B. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with the ACE 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

C. Submit shop drawings for fabrication and erection of specific finished concrete surfaces as shown or specified. Show the general construction of forms including jointing, special formed joints or reveals, location and pattern of form tie placement, and other items which affect the exposed concrete visually. Submit form drawings for building columns, walls, fascias, and intersections, and concrete pan and joist system. Submit for typical sections only. ENGINEER's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is the CONTRACTOR's responsibility.

D. Submit six copies of laboratory test reports for concrete materials and mix design tests as specified.

E. Material Certificates may be provided in lieu of materials laboratory test reports. The material manufacturer and the CONTRACTOR, certifying that each material item complies with, or exceeds, the specified requirements shall sign material certificates.

1.4 CONCRETE MIX DESIGNS

A. All concrete materials shall be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier or if directed by the ENGINEER, mix proportions and concrete strength curves for regular cylinder tests, based on the relationship of 7-, 14- and 28-day strengths versus slump values of 2, 4, and 6 inches, all conforming to these SPECIFICATIONS, shall be established by

an approved ready-mix supplier or an independent testing laboratory. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders. The costs for preparation of mix designs (if required by the OWNER to be performed by an independent testing laboratory) and testing of concrete and materials shall be borne by the CONTRACTOR.

C. The exact proportions by weight of all materials entering into the concrete delivered to the jobsite shall conform to the approved mix design unless specifically so directed by the ENGINEER or Laboratory for improved specified strength or desired density, uniformity and workability.

D. The proportions of such mix design shall be based on a full cubic yard of hardened concrete.

E. Ready-mix companies or jobsite batch plants shall furnish delivery tickets, signed by a Certified Weighmaster, on which each shall state the weight of aggregates, sand, cement, admixtures and water, and the number of cubic yards of concrete furnished, which will be compared against the approved mix design.

F. There shall be no variation in the weights and proportions of materials from the approved mix design.

G. There shall be no variation in the quality and source of materials once they have been approved for the specific mix design.

1.5 READY-MIXED CONCRETE

Ready-mixed concrete shall conform to the requirements of ACI 301 and ASTM C 94. In case of conflict, ACI 301 shall govern.

1.6 SAMPLE

CONTRACTOR shall pour and finish one 2-foot square exposed aggregate concrete sample for ENGINEER's approval prior to construction if exposed aggregate is included on job.

1.7 JOB CONDITIONS

Maintain continuous traffic control and access for vehicular and pedestrian traffic as required for other construction activities as well as to adjoining facilities for regular operation. Utilize flagmen, barricades, warning signs and warning lights as required, to maintain a safe entrance and passage on all roads or drives abutting the project.

PART 2 PRODUCTS

2.1 WALL FORMS

A. Full Height Pours: The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

B. Wall Form Ties

1. Form ties which remain in the wall of a subgrade water-retaining structure shall have waterstops and a 1-inch minimum break back or cone depth.

2. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. The use of tie wires as form ties will not be permitted. Fully threaded stub bolts may be used in lieu of smooth ties with waterstops.

3. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Plugs shall be A-58 SURE PLUG as manufactured by DAYTON SUPERIOR, Santa Fe Springs, CA; phone: (714) 522-3442.

4. Ties shall positively secure the wall to the required dimension and hold the wall to that dimension prior to and during concrete placement.

C. Wall Form Stiffeners

1. Horizontal walers shall consist of structural steel channels, angles, or tubing of adequate size to retain the concrete without deflecting.

2. The walers shall be rolled or welded to the proper radii or offset brackets shall be used for shaping the wall to the dimensions shown on the DRAWINGS and shall be used both for inside and outside wall forms in direct contact with the wall panels and at vertical spacings of no more than 96 inches on center.

3. There shall be at least one such waler within 24 inches of the top and bottom of the wall.

4. The largest dimension of the steel waler shall be in the radial direction.

5. Vertical structural steel or wood members shall be used at a minimum horizontal spacing of 74 inches and shall have sufficient rigidity and strength to insure the proper vertical alignments with the aid of braces under all predictable stress conditions.

6. In lieu of the above, a different system and spacings may be used if it is satisfactorily demonstrated to the ENGINEER that it will be equally effective.

2.2 FORMS FOR EXPOSED FINISH CONCRETE

Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Finish in largest practicable sizes to minimize number of joints and to conform to joint system shown on DRAWINGS. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection. Use overlaid plywood complying with U.S. Product Standard PS-1 “B-B High Density Overlaid Concrete Form”, Class I. Use flexible spring steel forms or laminated boards free of distortion and defects to form radius bends as required.

2.3 FORMS FOR UNEXPOSED FINISH CONCRETE

A. Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

2.4 FORM MATERIALS

A. Form Coatings

Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound. Petroleum based coatings shall not be used for structures in creeks and waterways. Biodegradable coatings shall be used which will not contaminate the creeks/waterways or an alternate method for stripping the form shall be proposed.

B. Chamfers, Reveals, Drips

Provide preformed PVC or shaped wood or metal of size and profile as shown on DRAWINGS.

C. Cylindrical Columns and Supports

Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation. Provide units having “seamless” interior to minimize spiral gaps or seams.

D. Pan Forms

Provide forms for concrete pan-type construction complete with covers and end enclosures to form a true, clean, smooth concrete surface. Design units for easy removal without damaging placed concrete. Block adjoining pan units if required to avoid lateral deflection of formwork during concrete placement and compaction. Provide standard or tapered end forms, as shown.

If required, factory-fabricate pan form units to required sizes and shapes of the following:

1. Steel – 16-gauge minimum, free of dents, irregularities, sag and rust, or

2. Glass-Fiber Reinforced Plastic - Molded under pressure with matched dies, 0.11 inches minimum wall thickness.

E. Inserts

Provide metal inserts for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work. Provide “Parabolt” by the Molly Company, “Phillips Red-Head”, or “Burke” products. The CONTRACTOR is responsible for insuring that all required anchorage not specified in the project documents is installed per current building code and applicable ICC report requirements.

2.5 REINFORCING MATERIALS

A. Reinforcing Bar (rebar): ASTM A615 and as follows below>

Stirrups and Ties Grade 60 (Grade 40 may be used for #3 and smaller)

All other Uses Grade 60

B. Steel Wire: ASTM A82, plain, cold-drawn, steel.

C. Welded Wire Fabric (WWF): ASTM A185, welded steel wire fabric.

D. Supports for Reinforcement

Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars, and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise specified. Wood, brick, concrete blocks, and other devices will not be acceptable. For slabs-on-grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are hot-dip galvanized, after fabrication, or plastic protected or stainless steel protected.

E. Fiber Reinforcement – Collated polypropylene fiber, 3/4-inch, manufactured from 100 percent virgin homopolymer polypropylene, hydrophobic, in compliance with ASTM C116.

2.6 CONCRETE MATERIALS

A. Portland Cement

ASTM C150, Type II, unless otherwise acceptable to ENGINEER. Use only one brand of cement throughout the project, unless otherwise acceptable to the ENGINEER. The use of ground granulated blast furnace slag is not allowed.

B. Aggregates

ASTM C33 and as herein specified. Provide aggregates from a single source for all exposed concrete.

Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to the ENGINEER.

1. Fine Aggregate - Clean, sharp, natural sand free from loam, clay, lumps, or other deleterious substances. Dune sand, bank-run sand and manufactured sand are not acceptable.

2. Coarse Aggregate - Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:

    a. Crushed stone processed from natural rock or stone.

b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.

c. Maximum Aggregate Size - Not larger than one-fifth of the narrowest dimensions between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear space between individual reinforcing bars or bundles of bars.

3. These limitations may be waived if, in the judgment of the ENGINEER, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

4. In general, it is desired that normal commercial mixes using 1-1/2-inch or 3/4-inch maximum aggregate size be used.

5. Aggregate for exposed aggregate concrete shall consist of selected aggregate of washed clean river gravel in color range of medium to dark in browns and grays; material uniformly sized 5/8-inch to 3/4-inch.

C. Water: Clean, fresh, drinkable.

D. Air Entraining Admixture: ASTM C260.

E. Water-Reducing Admixture: ASTM C494, Type A.

F. Set-Control Admixtures: ASTM C494, as follows:

1. Type B, Retarding
2. Type C, Accelerating
3. Type D, Water-reducing and Retarding
4. Type E, Water-reducing and Accelerating

Calcium chloride will not be permitted in concrete, unless otherwise authorized in writing by the ENGINEER.

2.7 RELATED MATERIALS

A. Waterstops

Provide flat, dumbbell type, or centerbulb type waterstops at construction joints and other joints as shown. Size to suit joints or as shown. Provide PVC waterstops complying with Corps of ENGINEER's CRD-C 572. Waterstops to be Greenstreak 701 or approved equal. Split face waterstops will not be acceptable under any circumstances.

B. Flush Mount Davit Crane Base Sleeves

Provide flush-mounted base sleeve with cast-in-place concrete anchors for new construction or renovation in compliance with ASTM D1785 and B633-85. Provide one of the following products:

1. 3M DBI Sala Model#: 8510311

C. Bituminous and Fiber Joint Filler

Provide resilient and non-extruding type pre-molded bituminous impregnated fiberboard units complying with ASTM D1751, FS HH-F-341, Type 1 and AASHTO M 213. Provide one of the following products:

1. Elastite; Philip Carey/Celotex
2. Flexcell; Celotex Corp.
3. Crane Fiber 1390; W.R. Grace & Co.
4. Fibre; W.R. Meadows, Inc.
5. Tex-Lite; J & P Petroleum Prod. Inc.
6. Sonoflex; Sonneborn/Contech, Inc.

D. Joint Sealing Compound: See Section 07 92 00, Joint Sealants

E. Moisture Barrier

Provide moisture barrier cover over all prepared base material. Use only materials that are resistant to decay when tested in accordance with ASTM E154. The moisture barrier consists of heavy Kraft papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side. Provide Moistop, St. Regis, or equal.

F. Form Ties (for forms other than wall forms)

Factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Unless otherwise shown, provide ties so portion remaining within concrete after removal is at least 1-1/2 inches inside concrete. Unless otherwise shown, provide form ties, which will not leave holes larger than 1-inch in diameter in concrete surface.

G. Concrete Curing Materials

Acrylic curing and sealing compound - Water emulsion acrylic curing and sealing compound formulated of acrylic polymers of water-based carrier. W.R. Meadows, Inc. VOCOMP-20 or approved equal.

H. Epoxy Adhesive

Provide Sikadur 32 Hi-Mod or Sikadur 31 Hi-Mod Gel for application to wire-brushed and prepared existing concrete to be mated to new concrete. Apply per manufacturer's recommendations.

I. Chemical-Hardener Finish: Provide Hornolith from Tamms Industries or approved equal.

J. Non-slip Aggregate Finish

Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

K. Non-shrink Grout: See Section 03 60 00, Grouting.

2.8 PROPORTIONING NORMAL CONCRETE

A. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1. All measurements shall be by weight. All concrete admixtures will be by the same supplier to insure compatibility. If different suppliers are used, a memorandum from EACH admixture supplier will be provided stating the compatibility of their product with the other supplier's products.

B. The slump shall be between 2 inches and 4 inches when tested in accordance with ASTM Specifications C 143. Variations in the slump range may be allowed by the ENGINEER if admixtures, such as water reducers or superplasticizers, are utilized in the concrete mix. Regardless of the measured slump, the maximum allowable water-cement ratios as specified herein shall be strictly adhered to.

C. Compressive Strength, Water and Cement Content

Notwithstanding what has been stated here-before, and unless shown otherwise on the DRAWINGS, the concrete shall meet the following requirements. All concrete except as noted otherwise on the DRAWINGS shall have 4,000 pounds per square inch (psi) 28-day compressive strength. The maximum water content per 94-pound sack of cement is 4.5 gallons. The minimum cement content for the 4,000-psi mix is 6.0 sacks (94-pound sack of cement per cubic yard of concrete). Up to a maximum of 15 percent of cementatious material may be fly ash in accordance with ASTM C618. The use ground granulated blast furnace slag is not allowed.

D. Retarding Densifiers

1. All concrete (as defined in 2.9 below) used for wall construction shall also contain DARATARD-17, as manufactured by Grace Const. Products, Cambridge, MA or MBL-82, as manufactured by Master Builders, Cleveland, OH in the amounts recommended by the additive manufacturer whenever the air temperature during the pour exceeds 85 degrees Fahrenheit (F).

2. To be considered as equal, any alternate product offered for consideration shall contain no calcium chloride and shall be compatible with air-entrained cements and air-entraining admixtures conforming to the applicable ASTM, AASHTO, ANSI and Federal specifications.

3. CONTRACTOR shall certify that admixtures do not contain calcium chlorides or other corrosive materials.

E. Air-Entraining Agents

1. All concrete that that is specified to be air entrained or that may be exposed to freeze/thaw action either during construction or the service life of the structure must be air entrained. Sufficient air-entraining agent shall be used to provide total air content of 5 percent, +/- 1 percent.

2. Air-entraining agents shall meet ASTM C 260, ASTM C 233 and ASTM C 457.

3. The maximum total volumetric air content of the concrete before placement shall be 6 percent plus or minus one percent as determined by ASTM C 173 or ASTM 231.

4. Subject to these SPECIFICATIONS, consideration will be given to the following products: PROTEX "AES," GRACE "DAREX AEA," MASTER BUILDERS "MB-AE10," or SIKA CHEMICAL "AER."

F. Water Reducing Admixtures

1. In addition to air-entrainment, approved water reducing additives, which do not affect the ultimate performance of any steel in any way, may be added to maintain the maximum water content below that specified herein. Water reducing additives shall conform to ASTM C 494, Type A or D.

2. The use of water reducing additives shall not permit a reduction in the minimum specified cement content or in the specified amount of air-entrainment.

3. Admixtures shall contain no calcium chloride, tri-ethanolamine or fly ash. All admixtures shall be from the same manufacturer.

4. Superplasticizers, if allowed by the ENGINEER, shall conform to ASTM C 494, Type F or G, batch plant added using second or third generation only.

5. Set control admixtures if allowed by the ENGINEER, shall conform to ASTM C 494, Type B (retarding) or Type C (accelerating).

G. Fiber reinforcement admixture shall be included in the ready-mix concrete design used for filling and channeling the wet well chambers. Fibers shall be used in strict accordance with the manufacturer's directions.

2.9 CONCRETE MIXING

Ready-Mix Concrete - Comply with the requirements of ASTM C94, and as herein specified. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required. When the air temperature is between 85 degrees F and 90 degrees F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F, reduce the mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 FORMS

A. Design, erect, support, brace, and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formworks so concrete members and structures are of correct size, shape, alignment, elevation, and position.

B. Design formworks to be readily removable without impact shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets,

chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Erect falsework and support; brace and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures.

Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

F. Forms for Exposed Concrete

Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes. Do not use metal cover plates for patching holes or defects in forms. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections. Use extra studs, walers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material, which will produce bow. Assemble forms so they may be readily removed without damage to exposed concrete surfaces. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

Corner Treatment - Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise indicated.

G. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings of forms at inconspicuous locations.

H. Chamfer exposed corners and edges, reveals and drips as shown using wood, metal, PVC or rubber strips fabricated to produce uniform smooth lines and tight edge joints.

I. Provisions for Other Trades - Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such ties. Accurately place and securely support items built into forms.

J. Cleaning and Tightening - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms after concrete placement if required to eliminate mortar leaks.

3.2 PLACING REINFORCEMENT

Detail and place according to ACI Manual SP-66. Unless otherwise noted, minimum cover shall be 1-1/2 inches for No. 5 and smaller bars, 2 inches for No. 6 and larger bars and 3 inches when poured against earth. Unless otherwise noted, bend all horizontals reinforcing a minimum of 2 feet at corners and wall intersections.

A. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

C. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus 2 inches, and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.3 JOINTS

A. Construction Joints - Locate and install construction joints, which are not shown on the DRAWINGS, so as not to impair the strength and appearance of the structure, as acceptable to the ENGINEER.

B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Unless otherwise specified, reinforcement shall be lapped in accordance with ACI Standards.

C. Waterstops - Provide waterstops in construction joints as shown on the DRAWINGS. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from any joint.

D. Isolation Joints in Slabs-on-Ground - Construct isolation joints in slabs-on-ground at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

E. Control Joints in Slabs-on-Ground - Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4-inch wide by one-fifth to one-fourth of the slab depth, unless otherwise shown.

1. Form control joints by inserting a pre-molded hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. After the concrete has cured, remove inserts and clean groove of loose debris.

2. Joint sealant material shall be as specified above.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General - Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs - Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screed strips by the use of strike-off templates or accepted compacting type screeds.

C. Cast in Place Reglets - Place in straight and continuous lines as detailed to enable flashing to be applied continuously without deviation at reglet joints more than 1/8-inch. Miter corners for continuous reglet joint where outside corners occur. At inside corners extend one section 1-inch past corner. Adequately anchor or secure reglets per manufacturer's instructions prior to pouring and during construction to insure dimensional tolerances and alignment. Vibrate concrete to insure concrete cover adjacent to and around reglet. Visually inspect after pouring and patch as required.

3.5 PREPARATION OF FORM SURFACES

Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Thin formcoating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Use dissipating-type form oil at surfaces to receive cement plaster finish. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Pre-Placement Inspection

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work as required. Notify ENGINEER in time for inspection prior to pouring.

2. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.

3. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

4. Concrete Curbs and Paving - Do not place concrete until subbase is completed and approved by the ENGINEER as required to provide uniform dampened condition at the time concrete is placed. Moisten subbase as required to provide uniform dampened condition at the time concrete is placed.

B. Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified herein. Perform concrete placing at such a rate that concrete, which is being integrated, with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to re-handling or flowing. Do not subject concrete to any procedure, which will cause segregation.

2. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable or does not meet the required quality control limits or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location. Do not use concrete whose allowable mixing time has been exceeded.

C. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods, which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

3. The CONTRACTOR shall provide traffic control on the narrow access roads to the work sites.

4. The CONTRACTOR shall not wash concrete trucks/chutes/equipment off at the project site unless plastic tarps and hay bales are employed to contain the concrete. The CONTRACTOR will be required to haul off-site all concrete contaminated soil.

D. Placing Concrete into Forms

1. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

2. Do not interrupt successive placement; do not permit cold joints to occur.

3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.

4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. Vibration of forms and reinforcing will not be permitted.

5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

6. Do not place concrete in supporting elements until the concrete previously placed in columns and walls is no longer plastic.

E. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment so the concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground, as specified for formed concrete structures. Consolidate concrete in the remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other acceptable methods. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

4. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

F. Bonding

1. Roughen surfaces of set concrete at all joints except where bonding is obtained by use of concrete bonding agent, and clean surfaces of laitance, coatings, loose particles and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and not to leave laitance, loose particles of aggregate or damaged concrete at the surface.

2. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:

a. At joints between footings and walls or columns, and between walls or columns and beams or slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

b. At joints in exposed work; at vertical joints in walls; at joints in girders, beams, supported slabs and other structural members; and at joints designed to contain liquids; dampen, but do not saturate the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout.

c. Use neat cement grout consisting of equal parts Portland cement and fine aggregate by weight and not more than 6 gallons of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16-inch. Deposit fresh concrete before cement grout has attained its initial set.

d. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instructions of the bonding material manufacturer.

3. Prepare for bonding of fresh concrete to fully cured hardened concrete or existing concrete by using an epoxy-resin-bonding agent as follows:

a. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instructions, including safety precautions.

b. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.

c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16-inch thick. Place fresh concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the epoxy-resin manufacturer.

G. Cold Weather Placing

1. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.

2. When the air temperature has fallen to or is expected to fall below 40 degrees F, provide adequate means to maintain the temperature in the area where concrete is being placed at either 70 degrees F for 3 days or 50 degrees F for 5 days after placing. Provide temporary housing or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Keep concrete moist. Avoid rapid dry-out of concrete due to over-heating and avoid thermal shock due to sudden cooling or heating.

3. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50 degrees F, and not more than 80 degrees F, at point of placement.

4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.

5. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cover reinforcing steel with water soaked burlap if it becomes too hot so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.

5. Do not use retarding admixtures unless otherwise accepted in mix designs.

3.7 FINISH OF FORMED SURFACES

A. Rough Form Finish

For formed concrete surfaces not exposed to view in the finish work or covered by other construction, unless otherwise shown or specified. This is the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.

B. Smooth Form Finish

Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view. Or that are to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

C. Curb Finishes

Curbs shall be screeded off accurately to true lines and planes or warped surfaces as indicated or directed. Finish smooth. Arises shall be true and straight or properly eased where curved

and neatly rounded with approved tool. Smooth trowel finish with corners rounded to 3/4-inch radius.

D. Grout Cleaned Finish (Sacked)

Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment, and to all exposed to view interior and exterior building surfaces, typical.

Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with water to the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces

At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.8 MONOLITHIC SLAB FINISHES

A. Float Finish

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing or sand bed terrazzo, and as otherwise shown on DRAWINGS or in schedules.

2. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both. Consolidate the surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding 1/4-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill at low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

B. Trowel Finish

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, paint, or other thin-film finish coating system.

2. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

C. Exposed Aggregate Finish

1. Screed to true plane, bullfloat surfaces, provide uniform double troweled finish. After troweling, let set until hard enough to wash without disturbing coarse aggregates. Simultaneously brush and spray with water to expose large aggregate and produce texture to match approved sample. Water cure or keep wet for 25 hours.

2. Scrub surface after 24 hours with a 1-part muriatic acid to 10-part water solution. Rinse thoroughly.

D. Broom Finish (Non-Slip)

1. Apply non-slip, broom finish to exterior concrete platforms, steps and ramps and elsewhere as shown on the DRAWINGS or in schedules.

2. Immediately after trowel finish, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route or in the direction of water flow. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the ENGINEER before application.

E. Chemical-Hardener Finish

1. Apply chemical curing-hardening compound or chemical-hardener to all interior concrete floors which will not receive applied finish materials. Mask adjacent work and surfaces to avoid over spray. Apply liquid chemical-hardener after complete curing and drying of the concrete surface.

2. Dilute the liquid hardener with water and apply in accordance with the manufacturer's printed directions. Evenly apply each coat and allow for drying between coats in accordance with manufacturer's printed directions.

3. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

F. Non-slip Aggregate Finish

Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as shown on the DRAWINGS or in schedules.

After completion of float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using steel trowel, but do not force the non-slip aggregate particles below surface.

After broadcasting and tamping, apply trowel finish as herein specified. After curing, lightly work the surface with a steel wire brush, or an abrasive stone, and water to expose the non-slip aggregate.

3.9 SCHEDULE OF CONCRETE SURFACE FINISHES

Also see Section 09 90 00, Painting and Coating for protective coating requirements.

	Surface Description	Type	Finish Requirement
A.	Interior Horizontal Slabs	Slab	Trowel Finish
B.	Exterior Horizontal Slabs	Slab	Broom Finish (Non-Slip)
C.	Stair Treads, Platforms and Ramps	Slab	Non-Slip Aggregate
D.	Interior Vertical Surfaces (including Wet Well)	Formed	Smooth Form
E.	Exterior Vertical Surfaces Exposed to View	Formed	Smooth Form

3.10 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

Perform curing of concrete by moist curing, by moisture-retaining cover curing, by membrane curing, or by combinations thereof, as herein specified. Provide the curing methods indicated as follows:

1. For concrete floor slabs provide moisture curing, moisture cover curing, or liquid membrane/chemical curing-hardening curing. If liquid membrane curing is used, it must be compatible with concrete hardening compounds to be applied later.

2. For other concrete work, provide moisture curing or moisture cover curing. Do not use liquid membrane or chemical curing-hardening curing on any concrete work to receive any applied finishes.

3. For curing, use only water that is free of impurities, which could etch or discolor exposed, natural concrete surfaces.

4. Provide moisture curing by any of the following methods:

    a. Keeping the surface of the concrete continuously wet by covering with water.

    b. Continuous water-fog spray.

    c. Covering the concrete surface with the specified absorptive cover thoroughly saturated with water and keeping the absorptive cover continuously wet. Place absorptive cover so as to provide coverage of the concrete surfaces and edges with a 4-inch lap over adjacent absorptive covers.

5. Provide moisture-cover curing as follows - Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete placed in the widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.

6. Provide liquid membrane curing as follows:

    a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a coat continuous operation by power spray equipment in accordance with the manufacturer's directions. Recoat areas, which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.

    b. Do not use membrane-curing compounds on surfaces, which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete. Such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the ENGINEER.

7. Curing Formed Surfaces - Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs, and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

8. Curing Unformed Surfaces

    a. Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing, whenever possible.

    b. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

c. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise acceptable to the ENGINEER.

9. Provide liquid curing-hardening compound as follows:

a. Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray or hair broom in accordance with manufacturer's directions.

C. Temperature of Concrete during Curing

1. When the atmospheric temperature is 40 degrees F and below, maintain the concrete temperature between 50 degrees F and 70 degrees F continuously throughout the curing period. When necessary, make arrangements before concrete placing for heating, covering, insulation, or housing as required to maintain the specified temperature and moisture conditions continuously for the concrete curing period. Provide cold weather protections complying with the requirements of ACI 306.

2. When the atmospheric temperature is 80 degrees F, and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protections complying with the requirements of ACI 305.

3. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete, which exceed 5 degrees F in any 1-hour and 50 degrees Ft in any 24-hour period.

D. Protection from Mechanical Injury - During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In - Fill-in holes and openings in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Curbs - Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations - Provide machine and equipment bases and foundations as shown on the DRAWINGS. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

3.12 REMOVAL OF SHORES AND FORMS

A. Remove shores and re-shore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate re-shoring to safely support the work without excessive stress or deflection.

Keep re-shores in place a minimum of 15 days after placing upper tier, and longer if required, until the concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulative curing at not less than 50 degrees F for 24 hours after placing concrete. Providing the concrete is sufficiently hard to not be damaged by form removal operations and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joints, slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location or members.

D. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

E. Re-Use of Forms

Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, except as acceptable to the Architect.

No forming material will be allowed to be built permanently into exposed visible surfaces.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas

1. Repair and patch defective areas with cement mortar immediately after removal of forms but only when directed by the ENGINEER.

2. Cut out honeycomb, rock pockets, voids over 1/2-inch diameter, and holes left by tie rods and bolts down to solid concrete but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water and brush-coat the area to be patched with neat

cement grout. Proprietary patching compounds may be used when acceptable to the ENGINEER.

3. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

B. Repair of Formed Surfaces

1. Repair exposed-to-view formed concrete surfaces that contain defects, which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the ENGINEER. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolt; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.

2. Repair concealed formed concrete surfaces that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01-inch wide, cracks or any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corners.

C. Repair of Unformed Surfaces

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as specified herein.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as specified herein.

3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop outs, honeycomb, rock pockets, and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so those repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the ENGINEER.

6. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with a neat cement grout coating, or use concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same material to provide concrete of the same type or class as the original adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

7. Repair isolated random cracks and single holes not over 1-inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

8. For repair of existing unformed surfaces, mechanically remove all lose concrete as required to expose sound aggregate. Clean concrete surfaces to achieve a contaminate free, open textured surface. Square cut or undercut perimeter to minimum depth as specified by the repair mortar manufacturer. Remove all loose concrete around the exposed steel and hand tool or blast clean all portions of rebar with visible rust to near white metal finish. If half of the diameter of the reinforcing steel is exposed, chip out behind the reinforcing to a 1/2-inch minimum depth. Splice new reinforcing steel to existing where corrosion has depleted the cross-section area by 25 percent. Apply a corrosion inhibitor/primer/bonding agent to all exposed rebar and other steel components and to concrete surfaces to be repaired per manufacturer's requirements, such as Sika Armatec 110 . Apply a polymer-modified, cement-based, repair mortar, trowel applied as specified by the manufacturer, such as Sika MonoTop 615.

9. Repair methods not specified above may be used subject to the acceptance of the ENGINEER.

3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. CONTRACTOR will engage a special inspector/testing laboratory to perform all tests and to submit test reports to the ENGINEER and the OWNER.

B. Concrete shall be sampled and tested for quality control during the placement of concrete, as follows:

1. Sampling Fresh Concrete - ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump - ASTM 143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.

3. Air Content - ASTM C231, pressure method; one for each set of compressive strength test specimens.

4. Compression Test Specimen - ASTM C31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

5. Concrete Temperature - Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time a set of compression test specimens is made.

6. Compressive Strength Tests - ASTM C39; one set for each 100 cubic yards or fraction thereof, of each concrete class placed in any 1 day or for each 5,000 square feet of surface area placed; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

    a. When the frequency of testing will provide less than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

    b. When the total quantity of a given class of concrete is less than 50 cubic yards, the strength tests may be waived by the ENGINEER if, in his judgment, adequate evidence of satisfactory strength is provided.

    c. If required by the building official, perform strength tests of cylinders cured under field conditions. Field cured cylinders shall be taken and molded at the same time and from the same samples as the laboratory cured test cylinders. When the strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

C. Report test results in writing to the ENGINEER and the OWNER on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of CONTRACTOR, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type of break for both 7-day tests and 28-day tests.

D. Additional tests - The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the ENGINEER. The testing service shall conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. CONTRACTOR shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 03 21 00 - REINFORCING STEEL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all the work necessary to furnish all labor, materials, equipment, and services necessary to furnish reinforcing steel, accessories, welding, equipment and services, and place concrete reinforcement.

B. Section includes:

1. Reinforcing steel.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete Work.
B. Section 04 22 00 - Concrete Masonry Units.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Submit shop drawings of detailed placing and bending lists for the ENGINEER's approval before the reinforcement is fabricated.

C. Submit information on any reinforcing to be field bent as covered in Section 3.1.B.

D. Mill Certificates: Mill test certificates shall be submitted to the ENGINEER to certify that the reinforcing steel meets the specified requirements. Mill test certificates shall be furnished and paid for by the CONTRACTOR.

E. In addition, the ENGINEER may require that test samples be taken, and test certificates be furnished by a reputable material testing laboratory at the OWNER's expense.

1.4 REFERENCES

A. American Concrete Institute (ACI)

1. ACI 117 “Specifications for Tolerances for Concrete Construction and Materials and Commentary”

B. American Welding Society (AWS)

1. AWS D1.4 “Structural Welding Code – Reinforcing Steel”

C. ASTM International (ASTM)

1. ASTM A184 “Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement”

2. ASTM A615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement"

3. ASTM A706 "Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement"

4. ASTM A767 "Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement"

5. ASTM A775 "Standard Specification for Epoxy-Coated Steel Reinforcing Bars"

6. ASTM A884 "Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement"

7. ASTM A934 "Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars"

8. ASTM A955 "Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement"

9. ASTM A970 "Standard Specification for Headed Steel Bars for Concrete Reinforcement"

10. ASTM A1022 "Standard Specification for Deformed and Plain Stainless-Steel Wire and Welded Wire for Concrete Reinforcement"

11. ASTM A1044 "Standard Specification for Steel Stud Assemblies for Shear Reinforcement of Concrete"

12. ASTM A1055 "Standard Specification for Zinc and Epoxy Dual Coated Steel Reinforcing Bars"

13. ASTM A1060 "Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete"

14. ASTM A1064 "Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete"

D. Concrete Reinforcing Steel Institute (CRSI)

1. CRSI 10MSP "(2018) Manual of Standard Practice"
2. CRSI RB4.1 "(2016) Supports for Reinforcement Used in Concrete"

1.5 QUALITY CONTROL

A. The ENGINEER may require that test samples be taken, and test certificates be furnished by a reputable material testing laboratory at the OWNER's expense.

PART 2 PRODUCTS

2.1 DEFORMED REINFORCING BARS

A. Unless otherwise specified, reinforcing steel shall be Grade 60 billet steel conforming to ASTM Specification A615 or ASTM 706.

1. All such reinforcing shall be deformed steel bars with *deformations* conforming to the requirements set forth in ASTM Specification A615 or ASTM 706

2. Stirrups and Ties shall be Grade 60.

B. Spiral reinforcement and steel wire shall be cold-drawn steel wire conforming to the requirements of ASTM Specification A1064 unless shown otherwise on the Drawings.

C. Welded Wire Fabric (WWF) shall conform to ASTM Specification A1064.

D. Bar and rod mats for concrete reinforcement conforming to ASTM A184

E. Tie wire, 16 gauge or heavier black annealed wire.

F. Varying grades shall not be used interchangeably in structures.

G. Reinforcing bars shall conform to the requirements of ACI 318 with lengths and bends in accordance with the fabrication tolerances of ACI 117.

1. Reinforcing bars shall be shop fabricated unless approval is provided by the ENGINEER for field bends. See Section 3.1.B for additional information on field bending.

2. Bending shall be done cold and accomplished so that the steel will not be damaged.

3. Kinked bars shall not be used.

2.2 PLAIN REINFORCING BARS

Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A1064 unless shown otherwise on the Drawings.

Plain smooth dowels and ¼-inch diameter smooth bars conforming to ASTM A615 Grade 60.

2.3 SUPPORTS

A. Bar supports shall conform to ACI 315 and CRSI Manual of Standard Practice, Chapter 3, Bar Supports

B. Bar supports shall consist of approved high density "adobes", stainless steel chairs, plastic spacers, or plastic shim plates.

1. Brick, broken concrete masonry units, spalls, rocks or similar materials shall not be used for support of reinforcing steel.

2. Steel chairs shall be furnished with plastic tips when incorporated into concrete exposed to view, such as in the roof slab.

3. Plastic spacers shall be PRECO BARSPAN WHEELS, as manufactured by the PRECO CORPORATION or equal.

4. Plastic shim plates may be used to support the plastic spacers and shall be used to support the vertical reinforcing in the corewall, unless shown otherwise on the Drawings.

C. Hot-dipped Galvanized Reinforcing Bars

When reinforcing bars are indicated on the Drawings to be hot-dipped galvanized, they shall be galvanized in accordance with ASTM A767 and ASTM A143. The grade of reinforcing bars shall be as specified under Section 2.1. The bars shall be galvanized in conformance with a Class 1 coating and shall be galvanized after fabrication and shearing.

D. Steel Tie Wire: Annealed steel tie wire shall be used to fasten the reinforcing steel in place.

PART 3 EXECUTION

3.1 REINFORCING BARS

Comply with the specified codes and standards and Concrete Reinforcing Steel Institutes recommended practice for "placing reinforcing bars," for details and methods of reinforcement placement and supports, and as herein specified.

A. General

1. Mild steel reinforcing bars shall be furnished, cut, bent and placed as indicated on the Drawings.

2. At the time of placing concrete, all reinforcement shall be free from loose mill scale, rust, grease, oil, or other coating which might destroy or reduce its bond with concrete.

    a. Reinforcing bars with rust, mill scale or a combination of both will not be acceptable without cleaning or brushing provided that upon wire brushing a sample, the dimensions including height of deformations and weights shall not be less than the applicable ASTM requirements. Steel reinforcement which is to be placed in the work shall be stored under cover to prevent rusting and shall be placed on blocking such that no steel touches any ground surface.

3. All reinforcing steel placed in the work shall be tied together and supported in such a manner that displacement during placing of concrete and shotcrete will not occur.

4. When there is a delay in depositing concrete, reinforcement shall be re-inspected and cleaned when necessary.

B. Fabrication (Cutting and Bending)

1. Steel reinforcement shall be cut and bent in accordance with ACI 318 and to the tolerances of ACI 117 with approved practices and machine methods.

    a. Bar bending shall be performed in the shop and all bars shall be bent cold.

b. If field bending is required, submit locations requiring field bending to the ENGINEER for review and approval.

c. Rebending of reinforcing bars that have been bent incorrectly is not permitted.

d. Bending, rebending, or straightening of reinforcing bars that have been cast into concrete is not permitted.

2. Reinforcement shall be accurately formed to the dimensions indicated on the Drawings and on the bending schedule.

3. Bends for hooks on bars shall be made around a pin having a diameter not less than six times the minimum thickness of the bar.

4. Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

5. Do not use reinforcing that has any of the following defects:

   a. Bar lengths, depths, and bends beyond the specified fabrication tolerances.
   b. Bends or kinks not indicated on the drawings or approved shop drawings.
   c. Bars with reducing cross-section due to rusting or other causes.

6. Replace defective reinforcement with new reinforcement having the required shape, form, and cross-section area.

C. Minimum Bar Spacing

The clear distance between parallel bars shall not be less than one and one-half times the diameter of the bars and, unless specifically authorized, shall in no case be less than 1-inch, nor less than the maximum size of coarse aggregate specified.

D. Concrete Cover (Minimum)

1. On all formed surfaces which will be exposed to water, ground or the elements, there shall be a nominal cover over the steel of 2.0-inches for bars number 6 through number 18 and 1-1/2 inches for bars number 5 and smaller, with an installation tolerance of + 1/4 inch. When crossing bars of different diameter are encountered in one face, one shall consider the bar size and location that will provide the largest cover over the nearest steel to the outside surface.

2. Unless otherwise specified in these specifications or shown on the Drawings, all reinforcing steel facing subgrades for concrete construction of the foundation or below-grade elements shall be given a nominal protective cover of 3.0-inch minimum. The largest cover shall be used when different size bars are encountered in one face.

3. The minimum cover over reinforcing steel for concrete construction of other facilities shall be as shown on the Drawings.

4. No "bury" or "carrier" bars will be allowed unless specifically approved by the ENGINEER.

E. Splicing

1. Except as shown or specified on the Drawings, reinforcing steel shall not be spliced at any location without specific approval by the ENGINEER. Splices in adjacent bars shall be staggered.

2. Where permitted or required, splices in reinforcing steel shall have sufficient lap to transfer full strength of the bar by bond and shear. Unless specified or shown otherwise on the Drawings, the bars at a lap splice shall be in contact with each other. In no event shall the lap be less than 40 diameters of the spliced bars.

3. Unless specified or shown otherwise on the Drawings, bars shall be lap spliced in accordance with ACI 318 and shall be fastened together with steel tie wire.

4. Unless shown otherwise on the Drawings, where bars are to be lapped spliced at joints in the concrete, all bars shall project from the concrete first placed, a minimum length equal to the lap splice length indicated on the Drawings. All concrete or other deleterious coating shall be removed from dowels and other projecting bars by wire brushing or sandblasting before the bars are embedded in a subsequent concrete placement.

F. Supports

1. All reinforcement shall be retained in place, true to indicated lines and grades, by the use of approved bar supports. The CONTRACTOR shall submit for ENGINEER's approval, samples of all bar supports he proposes to use along with a written description of where each bar support will be used.

2. The supports shall be of sufficient quantity, strength, and stability to maintain the reinforcement in place throughout the concreting operations. Bar supports shall be placed no further than 4 feet apart in each direction. Supports must be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete. The CONTRACTOR shall be held responsible for providing the appropriate quantity and type of bar supports.

3. Do not place reinforcing bars more than two inches beyond the last leg on continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

G. Bar Tying

1. Bars shall be tied sufficiently often to prevent shifting. There shall be at least three ties in each bar length (this shall not apply to dowel laps or to bars shorter than 4 feet, unless necessary for rigidity).

2. Slab bars shall be tied at every intersection around the periphery of the slab. Wall bars and slab bar intersections shall be tied at not less than every fourth intersection, but at not greater than the following maximum spacings:

	Slab Bars (in)	Wall Bars (in)
Bars No. 5 and smaller	60	48
Bars No. 6 through No. 9	96	60
Bars No. 10 through No. 11	120	96

H. Reinforcement Around Openings -- Where reinforcing steel has to be cut to permit passage of pipe or to create openings, and should no detail be shown for extra reinforcing in such areas, the area of steel removed by the creation of the opening must be replaced by placing at least double the area of steel removed by the opening equally around the openings. The steel shall be placed such that it extends 5 feet beyond the opening on each side to provide for sufficient bond.

END OF SECTION

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE WORK

PART 1 GENERAL

1.1 SUMMARY

A. The extent of concrete work is shown on the Drawings.

B. Work includes providing formwork and shoring for cast-in-place concrete and installation of related items including reinforcing steel bar (rebar), anchor bolts, setting plates, bearing plates, anchorages, inserts, reveals, frames, nosings, sleeves and other items to be embedded in concrete.

C. Definitions

1. Batch: Used in this specification to define an overall class of concrete as delivered from a concrete batching plant or on-site batching operation. Batching operations can continue for hours or days and as long as the class of concrete is similar, the batch would be considered the same. Multiple mixer truck loads could be used to deliver a "batch" of concrete over the course of multiple hours or days.

2. Batched/Batching: The loading of concrete, as combined and mixed at a batching/ready-mix plant, into a concrete mixer truck for delivery to the job site.

3. Truckload: A standard concrete mixer truck size is assumed to have a concrete capacity of 8 cubic yards. A truckload is used to help define the frequency of testing which of occurs per concrete mixer truck.

4. Ready-Mix Concrete: Concrete that is manufactured in a batch plant, according to a set engineered mix design. This specification assumes ready-mix concrete will be delivered by mixer truck to the job site.

1.2 RELATED SECTIONS:

A. Section 03 21 00 - Reinforcing Steel.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. For information only, submit a electronic copy of manufacturer's data with application and installation instructions for proprietary materials and items, including reinforcement, and forming accessories, admixtures, patching compounds, water stops, joint systems, chemical floor hardeners, dry-shake finish materials, and others. Bind and submit in one submittal.

C. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with the ACE 315 "Guide to Presenting Reinforcing Steel Design Details" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures and indicate proposed spacer or carry bars.

D. Submit shop drawings for fabrication and erection of specific finished concrete surfaces as shown or specified. Show the general construction of forms including jointing, special formed joints or reveals, location and pattern of form tie placement, and other items which affect the exposed concrete visually. Submit form drawings for building columns, walls, fascias, and intersections, and concrete pan and joist system. Submit for typical sections only. ENGINEER's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is the CONTRACTOR's responsibility.

E. Submit electronic copy of laboratory test reports for concrete materials, and mix design tests as specified.

F. Material Certificates may be provided in lieu of materials laboratory test reports. The material manufacturer and the CONTRACTOR, certifying that each material item complies with, or exceeds, the specified requirements shall sign material certificates.

1.4 REFERENCES

Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified here:

A. American Concrete Institute (ACI)

ACI 301 "Specifications for Concrete Construction"

ACI 311 "Guide for Concrete Inspection"

ACI 318 "Building Code Requirements for Structural Concrete"

ACI 347 "Guide to Formwork for Concrete"

ACI 304 "Guide for Measuring, Mixing, Transporting and Placing Concrete"

ACI 308R "Guide to External Curing of Concrete"

B. American Society for Testing and Materials (ASTM)

1. A1064, "Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete"
2. C31, "Making and Curing Concrete Test Specimens in the Field"
3. C33, "Specification for Concrete Aggregate"
4. C39, "Compressive Strength of Cylindrical Concrete Specimens"
5. C40, "Organic Impurities in Fine Aggregate for Concrete"
6. C85, "Cement Content of Hardened Portland Cement Concrete"
7. C88, "Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate"
8. C94, "Standard Specifications for Ready-Mixed Concrete"

9. C131, “Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine“

10. C136, “Method for Sieve Analysis to Fine and Coarse Aggregate“

11. C138, “Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete -- eLearning Course“

12. C143, “Slump of Portland Cement Concrete“

13. C150, “Standard Specification for Portland Cement“

14. C156, “Water Retention by Concrete Curing Materials“

15. C173, “Air Content of Freshly Mixed Concrete by the Volumetric Method“

16. C231, “Air Content of Freshly Mixed Concrete by the Pressure Method“

17. C233, “Standard Method of Testing Air-Entraining Admixtures for Concrete“

18. C260, “Standard Specifications for Air-Entraining Admixtures for Concrete“

19. C441, “Standard Test Method for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to the Alkali-Aggregate Reaction“

20. C457, “Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete“

21. C494, “Standard Specifications for Chemical Admixtures for Concrete“

22. C670, “Preparing Precision Statements for Test Methods for Construction Materials“

23. C803, “Penetration Resistance of Hardened Concrete“

24. C1064, “Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete“

25. C1602, “Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete“

26. C1778, “Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete“

27. E96, “Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials“

28. E1745, “Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs“

C. Comply with building code requirements which are more stringent than the above and all OSHA requirements.

1.5 QUALITY ASSURANCE

A. Workmanship

The CONTRACTOR is responsible for correction of concrete work that does not conform to the specified requirements, including strength, tolerances, and finishes. Correct deficient concrete as directed by the OWNER or ENGINEER. The CONTRACTOR shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

B. Concrete Testing Service

The OWNER or a representative of the OWNER will engage a special inspector/testing laboratory to perform material evaluation tests and to design concrete mixes. See detailed requirements in Part 3.14 "Quality Control Testing during Construction". Per the OWNER or ENGINEER's requirements the CONTRACTOR shall notify the designated representative to schedule the special inspections and materials testing required by the project documents.

C. Testing Requirements

Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at anytime during the progress of the work. Allow free access to material stockpiles and facilities at all times.

The costs for preparation of mix designs (if required by the OWNER to be performed by an independent testing laboratory) and testing of concrete and materials shall be borne by the OWNER, except when materials do not meet specified requirements, in which case such costs shall be borne by the CONTRACTOR.

D. Tests for Concrete Materials

1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the methods of test of ASTM C150.

3. Submit written reports to the OWNER and ENGINEER, for each material sampled and tested prior to the start of work. Provide the project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

4. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing. The materials producer and the CONTRACTOR must sign certificates of compliance.

E. Allowable Tolerances:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:

a. Variation from plumb in lines and surfaces of columns, piers, walls and rises; 1/4-inch per 10 feet, but not more than 1-inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum; 1/2-inch maximum in 40 feet or more.

b. Variation from level or grade in slab soffits, ceilings, beam soffits, and rises 1/4-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum, and 3/4-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum and 1/2-inch in 40 feet or more.

c. Variation from position of the linear lines and related columns, walls, and partitions, 1/2-inch in any bay or 20 feet maximum, and 1-inch in 40 feet or more.

d. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4-inch.

e. Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls, minus 1/4-inch and plus 1/2-inch.

f. Variations in footing plan dimensions, minus 1/2-inch and plus two (2) inches; misplacement or eccentricity, two (2) percent of the footing width in direction of misplacement but not more than two (2) inches; thickness reduction, minus five (5) percent.

g. Variation in steps - In a flight of stairs, 1/8-inch for rise and 1/4-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.

h. Circular structures shall be constructed in a true circular form, with maximum variation of 1/4-inch from the dimensions shown on the plans.

2. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

3. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

F. Quality Control Testing During Construction

See Section 3 - Execution.

1.6 CONCRETE MIX DESIGNS

A. All concrete materials shall be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier or if directed by the ENGINEER, mix proportions and concrete strength curves for

regular cylinder tests, based on the relationship of 7, 14 and 28 day strengths versus slump values of two (2), four (4), and six (6) inches, all conforming to these Specifications, shall be established by an approved ready-mix supplier or an independent testing laboratory. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders.

Testing of concrete and materials shall be borne by the OWNER, except when materials do not meet specified requirements, in which case such costs shall be borne by the CONTRACTOR.

C. The exact proportions by weight of all materials entering into the concrete delivered to the jobsite shall conform to the approved mix design unless specifically so directed by the ENGINEER or Laboratory for improved specified strength or desired density, uniformity and workability.

D. The proportions of such mix design shall be based on a full cubic yard of hardened concrete.

E. Ready-mix companies or jobsite batch plants shall furnish delivery tickets, signed by a Certified Weighmaster, on which each shall state the weight of aggregates, sand, cement, admixtures and water and the number of cubic yards of concrete furnished, which will be compared against the approved mix design.

F. There shall be no variation in the weights and proportions of materials from the approved mix design.

G. There shall be no variation in the quality and source of materials once they have been approved for the specific mix design.

1.7 READY-MIXED CONCRETE

Ready-mixed concrete shall conform to the requirements of ACI 301 and ASTM C 94. In case of conflict, ACI 301 shall govern.

1.8 SAMPLE

Upon request by the OWNER or ENGINEER the CONTRACTOR shall pour and finish one 2-foot square exposed aggregate concrete sample for ENGINEER's approval prior to construction if exposed aggregate is included on job.

1.9 JOB CONDITIONS

Maintain continuous traffic control and access for vehicular and pedestrian traffic as required for other construction activities as well as to adjoining facilities for regular operation. Utilize flagmen, barricades, warning signs and warning lights as required, to maintain a safe entrance and passage on all roads or drives abutting the project.

PART 2 PRODUCTS

2.1 FORMS FOR EXPOSED FINISH CONCRETE

Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials, to provide

continuous, straight, smooth, exposed surfaces. Finish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection. Use overlaid plywood complying with U.S. Product Standard PS-1 "B-B High Density Overlaid Concrete Form", Class I. Use flexible spring steel forms or laminated boards free of distortion and defects to form radius bends as required.

2.2 FORMS FOR UNEXPOSED FINISH CONCRETE

A. Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit.

2.3 FORM MATERIALS

A. Form Coatings

Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound. Petroleum based coatings shall not be used for structures in creeks and waterways. Biodegradable coatings shall be used which will not contaminate the creeks/waterways or an alternate method for stripping the form shall be proposed.

B. Chamfers, Reveals, Drips

Provide preformed PVC or shaped wood or metal of size and profile as shown on drawings.

C. Cylindrical Columns and Supports

Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation. Provide units having "seamless" interior to minimize spiral gaps or seams.

D. Pan Forms

Provide forms for concrete pan-type construction complete with covers and end enclosures to form a true, clean, smooth concrete surface. Design units for easy removal without damaging placed concrete. Block adjoining pan units if required to avoid lateral deflection of formwork during concrete placement and compaction. Provide standard or tapered end forms, as shown.

If required, factory-fabricate pan form units to required sizes and shapes of the following:

1. Steel - 16 gauge minimum, free of dents, irregularities, sag and rust, or

2. Glass-Fiber Reinforced Plastic - Molded under pressure with matched dies, 0.11 inches minimum wall thickness.

E. Inserts & Embeds

Provide metal inserts for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work. Provide "Parabolt" by the Molly Company, "Phillips Red-Head", "Burke" or approved equal products. The CONTRACTOR is responsible for insuring that all required anchorage not specified in the project documents is installed per current building code and applicable ICC report requirements.

2.4 REINFORCING MATERIALS

A. See Section 03 21 00 – Reinforcing Steel for additional information.

B. Reinforcing Bar (rebar): ASTM A615 or ASTM 706 and as follows below

Stirrups and Ties	Grade 60
All other Uses	Grade 60

C. Steel Wire: ASTM A1064, plain, cold-drawn, steel.

D. Welded Wire Fabric (WWF): ASTM A1064, welded steel wire fabric.

E. Supports for Reinforcement

Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise specified. Wood, brick, concrete blocks and other devices will not be acceptable. For slabs-on-grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are hot-dip galvanized, after fabrication, or plastic protected or stainless steel protected.

F. Fiber Reinforcement – Collated polypropylene fiber, ¾"-inch, manufactured from 100% virgin homopolymer polypropylene, hydrophobic, in compliance with ASTM C116.

2.5 CONCRETE MATERIALS

A. Portland Cement

ASTM C150, Type I or II or Type IL (per the limitations listed below) unless otherwise acceptable to ENGINEER. Use only one (1) brand of cement throughout the project, unless otherwise acceptable to the ENGINEER. The use of ground granulated blast furnace slag is not allowed.

1. Type IL cement shall only be allowed with an accompanying testing report indicating the surrounding soils/water sulfate levels are below the following limits:

   a. $SO_4 < 0.10$ water-soluble sulfate (SO_4) in soil percent by mass.
   b. $SO_4 < 150$ dissolved sulfate (SO_4) in water, ppm.

2. Alternatively Type IL cement shall be allowed if the C_3A content of the mix design is less than 5%.

B. Aggregates

ASTM C33 and as herein specified. Provide aggregates from a single source for all exposed concrete.

Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the ENGINEER.

1. Fine Aggregate - Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank-run sand and manufactured sand are not acceptable.

2. Coarse Aggregate - Clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter, as follows:

    a. Crushed stone processed from natural rock or stone.

    b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.

    c. Maximum Aggregate Size - Not larger than one-fifth (1/5) of the narrowest dimensions between sides of forms, one-third (1/3) of the depth of slabs, nor three-fourths (3/4) of the minimum clear space between individual reinforcing bars or bundles of bars.

3. These limitations may be waived if, in the judgment of the ENGINEER, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

4. In general it is desired that normal commercial mixes using 1-1/2-inch or 3/4-inch maximum aggregate size be used.

5. Aggregate for exposed aggregate concrete shall consist of selected aggregate of washed clean river gravel in color range of medium to dark in browns and grays; material uniformly sized 5/8-inch to 3/4-inch.

C. Water; Clean, fresh, potable: ASTM C1602.

D. Air Entraining Admixture: ASTM C260.

E. Water-Reducing Admixture: ASTM C494, Type A or F

F. Set-Control Admixtures: ASTM C494, as follows:

1. Type B, Retarding.
2. Type C, Accelerating.
3. Type D, Water-reducing and Retarding.
4. Type E, Water-reducing and Accelerating.

Calcium chloride will not be permitted in concrete, unless otherwise authorized in writing by the ENGINEER.

2.6 RELATED MATERIALS

A. Bituminous and Fiber Joint Filler

Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D1751, FS HH-F-341, Type 1 and AASHTO M 213. Provide one of the following products:

1. Elastite; Philip Carey/Celotex
2. Flexcell; Celotex Corp.
3. Crane Fiber 1390; W.R. Grace & Co.
4. Fibre; W.R. Meadows, Inc.
5. Tex-Lite; J & P Petroleum Prod. Inc.
6. Sonoflex; Sonneborn/Contech, Inc.

B. Vapor Barrier

Provide a vapor barrier over all prepared base material for interior areas. ASTM E1745 Class C polyethylene sheeting, minimum 15 mil thickness with a maximum permeance rating of 0.01 perms per ASTM E96, a minimum puncture resistance of 3000 grams per ASTM D1709 B, and a tensile strength of 70 lbs/in per ASTM E154 Section 9. Provide W.R. Meadows, Inc. Polyolefin Vapor Barrier - Perminator, or approved equal.

C. Form Ties (for forms other than wall forms)

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Unless otherwise shown, provide ties so portion remaining within concrete after removal is at least 1.5 inches inside concrete. Unless otherwise shown, provide form ties, which will not leave holes larger than 1-inch in diameter in concrete surface.

D. Concrete Curing Materials

Concrete curing materials shall be in accordance with ACI 301 Section 5 and ACI 308.1 Section 2.

1. Water-based resin curing compound. W.R. Meadows, Inc. 1100; Euclid Kurez DR VOX; or approved equal.

2. Acrylic curing and sealing compound. W.R. Meadows, Inc. CS-309-30, or approved equal.

3. Water emulsion acrylic curing and sealing compound formulated of acrylic polymers of water-based carrier. W.R. Meadows, Inc. VOCOMP-20, Euclid Luster Seal WB, or approved equal.

E. Epoxy Adhesive

For application to wire-brushed and prepared existing concrete to be mated to new concrete.

1. W.R. Meadows, Inc. INTRALOK, Sika Sikadur-32 Hi-Mod, Sika Armatec-100 EpoCem, or approved equal.

2. Apply per manufacturer's recommendations.

F. Chemical-Hardener Finish: Provide W.R. Meadows, Inc. Liqui-Hard (interior surfaces); W.R. Meadows, Inc. Med-Cure (exterior surfaces); or approved equal.

G. Non-slip Aggregate Finish

Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

H. Non-shrink Grout: See Section 03 60 00, Grouting.

2.7 PROPORTIONING NORMAL CONCRETE

A. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1. All measurements shall be by weight. All concrete admixtures will either be by the same supplier to insure compatibility. If different suppliers are used a memorandum from EACH admixture supplier will be provided stating the compatibility of their product with the other supplier's products.

B. The slump shall be between two inches and four inches when tested in accordance with ASTM Specifications C 143. Variations in the slump range may be allowed by the ENGINEER if admixtures, such as water reducers or superplasticizers, are utilized in the concrete mix. Regardless of the measured slump, the maximum allowable water-cement ratios as specified here-in, shall be strictly adhered to.

C. Compressive Strength, Water and Cement Content

Not withstanding what has been stated here-before, and unless shown otherwise on the Drawings, the concrete shall meet the following requirements. All concrete except as noted otherwise on the drawings shall have 4,500 psi 28-day compressive strength and a maximum water/cement ratio of 0.45. Up to a maximum of 15% of cementitious material may be fly ash in accordance with ASTM C618. The use ground granulated blast furnace slag is not allowed for any surfaces in contact with potable water.

D. Retarding Densifiers

1. All concrete (as defined in 2.9 below) used for wall construction shall also contain DARATARD-17, as manufactured by Grace Const. Products, Cambridge, MA or MBL-82, as manufactured by Master Builders, Cleveland, OH in the amounts recommended by the additive manufacturer whenever the air temperature during the pour exceeds 85° F.

2. To be considered as equal, any alternate product offered for consideration shall contain no calcium chloride, and shall be compatible with air-entrained cements and air-entraining admixtures conforming to the applicable ASTM, AASHTO, ANSI and Federal specifications.

3. CONTRACTOR shall certify that admixtures do not contain calcium chlorides or other corrosive materials.

E. Air-Entraining Agents

1. All concrete that that is specified to be air entrained or that may be exposed to freeze/thaw action either during construction or the service life of the structure must be air entrained.

2. Air-entraining agents shall meet ASTM C 260, ASTM C 233 and ASTM C 457.

3. The total volumetric air content of the concrete before placement shall be six (6) percent +/- 1.5 percent as determined by ASTM C 173 or ASTM 231 for mixes using a 3/4"nominal aggregate size.

4. Subject to these Specifications, consideration will be given to the following products: PROTEX "AES," GRACE "DAREX AEA," MASTER BUILDERS "MB-AE10," or SIKA CHEMICAL "AER."

F. Water Reducing Admixtures

1. In addition to air-entrainment, approved water reducing additives, which do not affect the ultimate performance of any steel in any way, may be added to maintain the maximum water content below that specified herein. Water reducing additives shall conform to ASTM C 494, Type A or D.

2. The use of water reducing additives shall not permit a reduction in the minimum specified cement content or in the specified amount of air-entrainment.

3. Admixtures shall contain no calcium chloride, tri-ethanolamine or fly ash. All admixtures shall be from the same manufacturer.

4. Superplasticizers, if allowed by the ENGINEER, shall conform to ASTM C 494, Type F or G, batch plant added using second or third generation only.

5. Set control admixtures if allowed by the ENGINEER, shall conform to ASTM C 494, Type B (retarding) or Type C (accelerating).

2.8 CONCRETE MIXING

A. Ready-Mix Concrete

1. Comply with the requirements of ASTM C94, and as herein specified. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required. When the air temperature is between 85°F and 90°F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90°F, reduce the mixing and delivery time to 60 minutes.

2. Minimum Mix Time: Once all materials are in the drum, the minimum mixing time shall be for 10 minutes before concrete is placed.

PART 3 EXECUTION

3.1 FORMS

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formworks so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design formworks to be readily removable without impact shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Erect falsework and support; brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures.

Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

F. Forms for Exposed Concrete

Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes. Do not use metal cover plates for patching holes or defects in forms. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material, which will produce bow. Assemble forms so they may be readily removed without damage to exposed concrete surfaces. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

Corner Treatment - Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise indicated.

G. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings of forms at inconspicuous locations.

H. Chamfer exposed corners and edges, reveals and drips as shown using wood, metal, PVC or rubber strips fabricated to produce uniform smooth lines and tight edge joints. A ½ inch chamfer at exposed edges is typical unless noted otherwise.

I. Provisions for Other Trades - Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such ties. Accurately place and securely support items built into forms.

J. Cleaning and Tightening - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement if required to eliminate mortar leaks.

3.2 PLACING REINFORCEMENT

Detail and place according to ACI Manual SP-66. Unless otherwise noted, minimum cover shall be 1-1/2 inches for No. 5 and smaller bars, 2.0-inches for No. 6 and larger bars or for any bars exposed to exterior or wet environments, and 3.0-inches when poured against earth. Unless otherwise noted, bend all horizontals reinforcing a minimum of two (2) feet at corners and wall intersections.

A. Clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

C. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Do not place reinforcing bars more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two (2) inches, and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.3 JOINTS

A. Construction Joints - Locate and install construction joints not shown on the drawings, so as not to impair the strength and appearance of the structure, as acceptable to the ENGINEER. Install and locate other construction joints as specified.

B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Unless otherwise specified, reinforcement shall be lapped in accordance with ACI Standards.

C. Isolation Joints in Slabs-on-Ground - Construct isolation joints in slabs-on-ground at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

D. Control Joints in Slabs-on-Ground - Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4-inch wide by one-fifth (1/5) to one-fourth (1/4) of the slab depth, unless otherwise shown.

1. Form control joints by the following methods

a. Inserting a premolded hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. After the concrete has cured, remove inserts and clean groove of loose debris.

b. Saw cutting a control joint in the required location. Plan for saw cutting so work does not damage reinforcing or violate edge distance minimums.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General - Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs - Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screed strips by the use of strike-off templates or accepted compacting type screeds.

C. Cast in Place Reglets - Place in straight and continuous lines as detailed to enable flashing to be applied continuously without deviation at reglet joints more than 1/8-inch. Miter corners for continuous reglet joint where outside corners occur. At inside corners extend one section 1-inch past corner. Adequately anchor or secure reglets per manufacturer's instructions prior to pouring and during construction to insure dimensional tolerances and alignment. Vibrate concrete to insure concrete cover adjacent to and around reglet. Visually inspect after pour and patch as required.

3.5 PREPARATION OF FORM SURFACES

Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Thin formcoating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Use dissipating-type form oil at surfaces to receive cement plaster finish. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Pre-Placement Inspection

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work as required. Notify ENGINEER in time for inspection prior to pouring.

2. Remove all garbage and debris from the base of formwork. Items such as aluminum cans, food containers, plywood, and their like are to be cleaned-up and disposed.

3. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.

4. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

5. Concrete Curbs and Paving - Do not place concrete until subbase is completed and approved by the ENGINEER as required to provide uniform dampened condition at the time concrete is placed. Moisten subbase as required to provide uniform dampened condition at the time concrete is placed.

B. Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete, which is being integrated, with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure, which will cause segregation.

2. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable or does not meet the required quality control limits or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location. Do not use concrete whose allowable mixing time has been exceeded.

C. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods, which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment

from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

3. The CONTRACTOR shall provide traffic control on the narrow access roads to the work sites.

4. The CONTRACTOR shall not wash concrete trucks/chutes/equipment off at the project site unless plastic tarps and hay bales are employed to contain the concrete. The CONTRACTOR will be required to haul off-site all concrete contaminated soil.

D. Placing Concrete into Forms

1. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

2. Do not interrupt successive placement; do not permit cold joints to occur.

3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.

4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. Vibration of forms and reinforcing will not be permitted.

5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete at least six (6) inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

6. Do not place concrete in supporting elements until the concrete previously placed in columns and walls is no longer plastic.

E. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment so the concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground, as specified for formed concrete structures. Consolidate concrete in the remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other

acceptable methods. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

4. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

F. Bonding

1. Roughen surfaces of set concrete at all joints except where bonding is obtained by use of concrete bonding agent, and clean surfaces of laitance, coatings, loose particles and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and not to leave laitance, loose particles of aggregate or damaged concrete at the surface.

2. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:

   a. At joints between footings and walls or columns, and between walls or columns and beams or slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

   b. At joints in exposed work; at vertical joints in walls; at joints in girders, beams, supported slabs and other structural members; and at joints designed to contain liquids; dampen, but do not saturate the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout.

   c. Use neat cement grout consisting of equal parts Portland cement and fine aggregate by weight and not more than six (6) gallons of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16-inch. Deposit fresh concrete before cement grout has attained its initial set.

   d. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instructions of the bonding material manufacturer.

3. Prepare for bonding of fresh concrete to fully cured hardened concrete or existing concrete by using an epoxy-resin-bonding agent as follows:

   a. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instructions, including safety precautions.

   b. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.

   c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16-inch thick. Place fresh

concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the epoxy-resin manufacturer.

G. Cold Weather Placing

1. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.

2. When the air temperature has fallen to or is expected to fall below 40°F, provide adequate means to maintain the temperature in the area where concrete is being placed at either 70°F for three (3) days or 50°F for five (5) days after placing. Provide temporary housing or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Keep concrete moist. Avoid rapid dry-out of concrete due to over-heating and avoid thermal shock due to sudden cooling or heating.

3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50°F, and not more than 80°F, at point of placement.

4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.

5. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cover reinforcing steel with water soaked burlap if it becomes too hot so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.

5. Do not use retarding admixtures unless otherwise accepted in mix designs.

3.7 FINISH OF FORMED SURFACES

A. Rough Form Finish

For formed concrete surfaces not exposed to view in the finish work or covered by other construction, unless otherwise shown or specified. This is the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.

B. Smooth Form Finish

Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view. Or that are to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

C. Curb Finishes

Curbs shall be screeded off accurately to true lines and planes or warped surfaces as indicated or directed. Finish smooth. Arises shall be true and straight or properly eased where curved and neatly rounded with approved tool. Smooth trowel finish with corners rounded to 3/4-inch radius.

D. Grout Cleaned Finish (Sacked)

Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment, and to all exposed to view interior and exterior building surfaces, typical.

Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with water to the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces

At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.8 MONOLITHIC SLAB FINISHES

A. Float Finish

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing or sand bed terrazzo, and as otherwise shown on drawings or in schedules.

2. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both. Consolidate the surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding 1/4-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill at low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

B. Trowel Finish

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, paint, or other thin-film finish coating system.

2. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

C. Exposed Aggregate Finish

1. Screed to true plane, bullfloat surfaces, provide uniform double troweled finish. After troweling, let set until hard enough to wash without disturbing coarse aggregates. Simultaneously brush and spray with water to expose large aggregate and produce texture to match approved sample. Water cure or keep wet for 25 hours.

2. Scrub surface after 24 hours with a one (1) part muriatic acid to10 part water solution. Rinse thoroughly.

D. Broom Finish (Non-Slip)

1. Apply non-slip, broom finish to exterior concrete platforms, steps and ramps and elsewhere as shown on the drawings or in schedules.

2. Immediately after trowel finish, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route or in the direction of water flow. Use fiber-

bristle broom unless otherwise directed. Coordinate the required final finish with the ENGINEER before application.

E. Chemical-Hardener Finish

1. Apply chemical curing-hardening compound or chemical-hardener to all interior concrete floors which will not receive applied finish materials. Mask adjacent work and surfaces to avoid over spray. Apply liquid chemical-hardener after complete curing and drying of the concrete surface.

2. Dilute the liquid hardener with water and apply in accordance with the manufacturer's printed directions. Evenly apply each coat and allow for drying between coats in accordance with manufacturer's printed directions.

3. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

F. Non-slip Aggregate Finish

Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as shown on the drawings or in schedules.

After completion of float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using steel trowel, but do not force the non-slip aggregate particles below surface. After broadcasting and tamping, apply trowel finish as herein specified. After curing, lightly work the surface with a steel wire brush, or an abrasive stone, and water to expose the non-slip aggregate.

3.9 SCHEDULE OF CONCRETE SURFACE FINISHES

Also see Section 09 90 00, Painting and Coating for protective coating requirements.

	Surface Description	Type	Finish Requirement
A.	Interior Horizontal Slabs	Slab	Broom Finish (Non-Slip)
B.	Exterior Horizontal Slabs	Slab	Broom Finish (Non-Slip)
C.	Stair Treads, Platforms and Ramps	Slab	Non-Slip Aggregate

3.10 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for the time period covered in Section 3.10.D and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

Perform curing of concrete by moisture curing (continuous wetting), by moisture-retaining cover curing (damp sand, burlap, canvas, or straw), by liquid membrane curing (liquid membrane-forming compound) or covering concrete with protective sheet materials (polyethylene plastic sheeting "visqueen" or similar) or by combinations thereof, as herein specified. Provide the curing methods indicated as follows:

1. For concrete floor slabs provide moisture curing, moisture cover curing or liquid membrane/chemical curing-hardening curing. If liquid membrane curing is used, it must be compatible with concrete hardening compounds to be applied later.

2. For other concrete work, provide moisture curing, moisture-retaining cover curing, membrane curing, or protective sheet covering. Do not use liquid membrane or chemical curing-hardening curing on any concrete work to receive any applied finishes.

3. Inspect concrete, regardless of current method selected, do not permit the concrete to become surface-dry at any time. For formwork left in place, ensure the wood formwork is wetted throughout the curing process.

4. For curing, use only water that is free of impurities, which could etch or discolor exposed, natural concrete surfaces.

5. Provide moisture curing by any of the following methods:

    a. Keeping the surface of the concrete continuously wet by covering with water.
    b. Continuous water-fog spray.

6. Provide moisture-retaining cover curing by any of the following methods:

    a. Covering the concrete surface with the specified absorptive cover thoroughly saturated with water and keeping the absorptive cover continuously wet. Place absorptive cover so as to provide coverage of the concrete surfaces and edges with a 4-inch lap over adjacent absorptive covers.

7. Provide sheet material cover curing as follows - Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete placed in the widest practicable width with sides and ends lapped at least three (3) inches and sealed by waterproof tape

or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.

a. Use minimum 4 mil thickness, clear or translucent polyethylene sheets “visqueen” or similar.

b. Support sheet material to prevent marking of the concrete surface.

8. Provide liquid membrane curing as follows:

a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a coat continuous operation by power spray equipment in accordance with the manufacturer’s directions. Recoat areas, which are subjected to heavy rainfall within three (3) hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.

b. Do not use membrane-curing compounds on surfaces, which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete. Such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the ENGINEER.

9. Curing formed Surfaces - Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

10. Curing Unformed Surfaces

a. Initially cure unformed surfaces, such as slabs, floor topping and other flat surfaces by moist curing, whenever possible.

b. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

c. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise acceptable to the ENGINEER.

11. Provide liquid curing-hardening compound as follows:

a. Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray or hair broom in accordance with manufacturer’s directions.

C. Temperature of Concrete during Curing

1. When the atmospheric temperature is 40°F and below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period. When necessary, make arrangements before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions

continuously for the concrete curing period. Provide cold weather protections complying with the requirements of ACI 306.

2. When the atmospheric temperature is 80°F, and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation wind breaks or shading, and for fog spraying, wet sprinkling or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protections complying with the requirements of ACI 305.

3. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete, which exceed 5°F in any one-hour and 50°F in any 24-hour period.

D. Curing Time

1. Cure concrete for the following times

a. ASTM C150 Type I concrete – Cure for 7 days after placement.
b. ASTM C150 Type II concrete – Cure for 10 days after placement.
c. ASTM C150 Type III concrete – Cure for 3 days after placement.
d. ASTM C150 Type IV and V concrete – Cure for 14 days after placement.

2. When permitted by the ENGINEER, curing operations can be ended once the results of two (2) cylinder tests show that the concrete has reached a strength of 85% f'c. However, no less than 3 days of curing shall occur.

E. Protection from Mechanical Injury - During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In - Fill-in holes and openings in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Curbs - Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations - Provide machine and equipment bases and foundations as shown on the drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

3.12 REMOVAL OF SHORES AND FORMS

A. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support the work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until the concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns and similar parts of the work, may be removed after cumulative curing at not less than 50°F for 24 hours after placing concrete. Providing the concrete is sufficiently hard to not be damaged by form removal operations and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location or members.

D. Form facing material may be removed four (4) days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

E. Re-Use of Forms

Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, except as acceptable to the Architect.

No forming material will be allowed to be built permanently into exposed visible surfaces.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas

1. Repair and patch defective areas with cement mortar immediately after removal of forms but only when directed by the ENGINEER.

2. Cut out honeycomb, rock pockets, voids over 1/2-inch diameter and holes left by tie rods and bolts down to solid concrete but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the ENGINEER.

3. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

B. Repair of Formed Surfaces

1. Repair exposed-to-view formed concrete surfaces that contain defects, which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the ENGINEER. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolt; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.

2. Repair concealed formed concrete surfaces that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01-inch wide, cracks or any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corners.

C. Repair of Unformed Surfaces

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so those repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the ENGINEER.

6. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to

sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with a neat cement grout coating, or use concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same material to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

7. Repair single holes not over 1 inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean off dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

8. For repair of existing unformed surfaces, mechanically remove all lose concrete as required to expose sound aggregate. Clean concrete surfaces to achieve a contaminate free, open textured surface. Square cut or under cut perimeter to minimum depth as specified by the repair mortar manufacturer. Remove all lose concrete around the exposed steel and hand tool or blast clean all portions of rebar with visible rust to near white metal finish. If half of the diameter of the reinforcing steel is exposed, chip out behind the reinforcing to a 1/2-inch minimum depth. Splice new reinforcing steel to existing where corrosion has depleted the cross-section area by 25%. Apply a corrosion inhibitor/primer/bonding agent to all exposed rebar and other steel components and to concrete surfaces to be repaired per manufacturer's requirements, such as Sika Armatec 110 . Apply a polymer-modified, cement-based, repair mortar, trowel applied as specified by the manufacturer, such as Sika MonoTop 615.

9. Repair methods not specified above may be used subject to the acceptance of the ENGINEER.

3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The OWNER or a representative of the OWNER will engage a special inspector/testing laboratory to perform all tests and to submit test reports to the OWNER, ENGINEER, and the CONTRACTOR.

B. Concrete shall be sampled and tested for quality control during the placement of concrete, as follows:

1. Sampling Fresh Concrete - ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump Test - ASTM C143; one (1) test for each set of compressive strength test specimens. Samples shall be taken at point of discharge.

3. Air Content - ASTM C231, pressure method; one (1) for each set of compressive strength test specimens.

4. Compressive Strength Test Specimen - ASTM C31; One (1) Set which consist of a minimum of four (4) standard cylinders to allow for compressive strength testing, unless otherwise directed. If early loading of members or sections is desired by the CONTRACTOR, additional tests cylinders shall be collected for testing. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

5. Concrete Temperature – ASTM C1064, Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compression test specimens is made.

6. Compressive Strength Tests - ASTM C39; One (1) Set for each 100 cubic yards or fraction thereof, of each concrete class placed in any one (1) day, OR for each 5,000 square feet of surface area placed, OR as per minimums outlined below.

    a. When the frequency of testing will provide less than five (5) Sets of cylinders by which to perform strength tests for a given class of concrete, conduct testing, as follows.

        1) For a class of concrete with a total batch size of greater than 500 cubic yards or 25,000 square feet of surface area, collect test Sets as outlined above.

        2) For a class of concrete with a total batch size of less than 500 cubic yards or 25,000 square feet of surface area, but greater than 300 cubic yards or 15,000 square feet of surface area, collect four (4) Sets for testing. Two (2) Sets near the beginning of pouring, one (1) Set mid-way through pouring and one (1) Set towards the end of pouring.

        3) For a class of concrete with a total batch size of less than 300 cubic yards or 15,000 square feet of surface area, but greater than 50 cubic yards or 2,500 square feet of surface area, collect three (3) sets of testing. One (1) Set near the beginning of pouring, one (1) Set mid-way through pouring and one (1) Set towards the end of pouring.

        4) When the total quantity of a given class of concrete is less than 50 cubic yards, and NO anchors are embedded in the concrete, the ENGINEER may waive the strength tests if, in their judgment, adequate evidence of satisfactory strength is provided. Otherwise testing shall occur as outlined in 3.14.B.6.a

    b. Testing Procedure: A Set of specimens with yield four (4) cylinders. Therefore, five (5) Sets will yield 20 cylinders, four (4) Sets will yield 16 cylinders, three (3) Sets will yield 12 cylinders, From each set test one (1) cylinder at seven (7) days, test two (2) cylinders at 28 days, and one (1) cylinder shall be retained in reserve for later testing if required. Additional cylinders can be obtained, at the CONTRACTOR's or OWNER's discretion, for testing at alternate times.

    c. If required by the building official, perform strength tests of cylinders cured under field conditions. Field cured cylinders shall be taken and molded at the same time and from the same samples as the laboratory cured test cylinders. When the strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

C. Report test results in writing to the ENGINEER and the CONTRACTOR on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of CONTRACTOR, name of concrete supplier and concrete mixing truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type of break for both 7-day tests and 28-day tests.

D. Additional tests - The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the ENGINEER. The testing service shall conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. CONTRACTOR shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 03 60 00 - GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all work necessary to form, mix, place, cure, repair, finish, and perform all other work as required to produce finished grout, in accordance with the requirements of the Contract Documents.

B. Work covered in this Section includes:

1. Patching, grouting, and sealing.
2. Grouting of door frames in CMU wall
3. Grouting for support of plumbing, fire sprinklers, and HVAC equipment
4. Grout for support of mechanical, electrical, and communications equipment
5. Removal of loose and spalling grout and concrete.
6. Anchoring cement for metal fabrications

Note: See Specification 04 05 17 Masonry Mortar and Grout for grout used in CMU walls.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-in-Place Concrete Work.
B. Section 05 50 00 –Metals Fabrications

1.3 SUBMITTALS

A. Manufacturer Technical Data and Strength Test Results: For sack-mix grouts used on minor-structure/systems provide datasheet information verifying the compressive strength, shrinkage, and expansion requirements specified herein for grout used.

B. Manufacturer's Literature: Containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of non-shrink and epoxy grout used in the work.

1.4 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Specifications, codes, and standards shall be as specified in Section 03 30 00, Cast-in-Place Concrete Work and as referred to herein.

Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified.

B. Codes and Standards

1. American Society for Testing and Materials (ASTM)

a. C1084, “Standard Test Method for Portland-Cement Content of Hardened Hydraulic-Cement Concrete”

b. C109, “Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens)”

c. C191, “Standard Test Method for Setting Time of Hydraulic Cement”

d. C131, “Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine”

e. C136, “Standard Test Method for Sieve Analysis to Fine and Coarse Aggregate”

f. C143, “Standard Test Method for Slump of Hydraulic Cement Concrete”

g. C150, “Standard Specification for Portland Cement”

h. C488, “Standard Test Method for Pull-Out Strength”

i. C531, “Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”

j. C579, “Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”

k. C827, “Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures”

l. C827, “Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures”

m. C882, “Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear”

n. C939, “Standard Test Method for Flow of Grout for Preplaced – Aggregate Concrete (Flow Cone Method)”

o. C942, Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory “”

p. C1090, “Standard Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic Cement Grout”

q. C1107, “Standard Test Method for Packaged Dry, Hydraulic Cement Grout (Non-Shrink)”

r. C1437, “Standard Test Method for Flow of Hydraulic Cement Mortar”

s. E488, “Standard Test Method for Strength of Anchors in Concrete and Masonry Elements”

2. American Concrete Institute (ACI)

a. “Guide to Hot Weather Concreting”, ACI 305R.

b. “Guide to Cold Weather Concreting”, ACI 306R.

c. “Guide for Selecting and Specifying Materials for Repair of Concrete Surfaces”, ACI 320.2R, as supplemented and modified herein.

3. CRD-C 621, Corps of Engineers Specification for Non-Shrink Grout

1.5 DELIVERY HANDLING AND STORAGE

A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number and shelf life.

B. Handle products in accordance with manufacturer’s printed recommendations. Do not place grout when temperature or humidity will affect the performance or appearance of the grout.

C. Store products in a dry area. Protect from direct sunlight.

D. Do not place grout on dirty, wet, or frozen substrates.

PART 2 PRODUCTS

2.1 PREPACKAGED GROUTS

A. High Strength Non-shrink grout: This type of grout is to be used wherever grout is required in the Contract Documents unless another type is specifically referenced.

1. High Strength Non-shrink grout shall be a prepackaged, inorganic, non-gas- liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation of each type of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

Early Height Change, ASTM C827	0.0 to +0.3%		
Hardened Height Change, ASTM C1090	+0.2 to +0.4%		
Effective Bearing Area	95%		
Compressive Strength, ASTM C942	Plastic	Flowable	Fluid
1 Day (min.)	1,000 psi	1,000 psi	1,000 psi
28 Days (min.)	5,000psi	5,000psi	5,000psi
Bond Strength, ASTM C882			
28 Days	2000psi		
Application Temperature	40°F to 90°F		
Material Temperature	40°F to 90°F		

B. General Purpose Non-Shrink Grout shall have minimum 28-day compressive strength of 2500 psi when tested and meet the shrinkage and expansion requirements listed for high strength non-shrink grout.

C. Application

1. High Strength Non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents.

2. General Purpose Non-Shrink Grout shall be used for non-structural, non-repair interior or exterior grout applications.

2.2 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed four (4) inches.

2.3 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers approved by the ENGINEER. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified by the manufacturer. The finish of the grout surface shall match that of the adjacent concrete.

B. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the ENGINEER.

3.2 GROUTING PROCEDURES

Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution of prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

3.3 Installation

A. Examination

1. Examine substrates and conditions under which materials will be installed. Do not proceed with Installation until unsatisfactory conditions are corrected.

2. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas landscaping from contact due to mixing and handling of materials.

B. Surface Preparation

Comply with manufacturer's printed instructions and the following:

1. Mechanically remove all unsound concrete to the limits indicated on the drawings. Remove cement paste and laitance to expose sound aggregate.

2. Clean surface to receive grout of all materials including dust, oil, dirt, and grease or Efflorescence.

3. Dampen with clean water before patching and remove standing water.

C. Specialized Installation Requirements

1. Grout in Steel Door Frames: Install non-metallic non shrink grout between masonry rough opening and door frames in masonry walls, fully filling frames with grout.

D. Formwork:

1. Comply with manufacturer's printed instructions and the following:

a. Forms must be watertight, strong, properly braced, and properly coated.

b. Allow a minimum clearance of 2 inches between forms and baseplate for grout entry.

c. Allow a minimum grout head of 6 inches.

d. Slope form on placing side to assist in grout movement and to prevent trapping air.

e. Allow 1-inch horizontal clearance and 1-inch vertical clearance for height above bottom of baseplate.

f. Provide venting of forms to avoid entrapment of air.

E. Mixing Requirements:

1. Comply with manufacturer's printed instructions and the following:

a. Do not re-temper with additional water.

F. Placement of Grout Materials:

1. Comply with manufacturer's printed instructions and the following:

a. The area to be grouted should be thoroughly flushed and soaked with clean water prior to grouting. Leave no standing water.

b. Place the grout quickly and continuously use light rodding or strapping to eliminate air bubbles.

c. Place grout mixture into prepared areas from one side or the other, rapidly and continuously, to reduce air entrapment. Avoid placing grout from opposite sides.

d. Grout temperature should be maintained from 50°F to 90°F to achieve specified results. Use cold water in hot weather or hot water in cold weather to achieve desired grout temperature. Do not use if temperature is expected to go below 32°F within a 12-hour period.

G. Curing Requirements:

1. Utilize a damp cure of at least 3 days is necessary to control the Non-Shrink characteristics and maintain strength levels.

2. Cover fresh grout and anchoring cement with plywood where exposed to construction traffic for 24 hours minimum.

H. Cleaning After Grout Placement

1. Remove excess material before material cures. If material has cured, remove using mechanical methods that will not damage substrate.

3.4 Completion

A. Adjusting Defective Work: Replace or patch grout and anchoring cement as directed by OWNER/ENGINEER/ARCHITECT

END OF SECTION

SECTION 04 05 17 - MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SCOPE

A. This Section includes all labor, materials and equipment required to complete masonry mortar and grout work required by the Contract Documents including, but not limited to, these major items:

1. Installation
2. Grouting.
3. Placement of vertical and horizontal reinforcing.
4. Cleaning of masonry.

B. Section Includes:

1. Masonry Grout.
2. Mortar.
3. Admixtures.
4. Masonry cleaners.

C. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete Work
2. Section 03 21 00 – Reinforcing Steel
3. Section 04 22 00 – Concrete Masonry Units

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
2. ASTM C204 - Standard Test Methods for Fineness of Hydraulic Cement by Air-Permeability Apparatus.
3. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
4. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
5. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
6. ASTM C476 - Standard Specification for Grout for Masonry.

1.3 SUBMITTALS

A. Masonry Grout design: Indicating type and proportions of the ingredients according to the proportion requirements herein and ASTM C 476.

1. In lieu of Masonry Grout design, submit the mix designs and grout strength test performed in accordance with ASTM C 476.

B. Mortar design: Indicating type and proportions of ingredients in compliance with the proportion specification herein and ASTM C 270.

1. In lieu of mortar design, submit the mix design and mortar tests performed in accordance with the property specification of ASTM C 270.

C. Color samples for OWNER selection of mortar color.

D. Material certificates certifying each material is in compliance for all Mortar and Grout materials and admixtures.

E. Construction procedures for Cold Weather Construction and/or Hot Weather Construction.

1. Adhere to the procedures and general practices provided for cast-in-place concrete in Section 03 30 00 Cast-in-Place Concrete Work

2. Implement Cold or Hot Weather general practices for the conditions listed in Section 1.4.E.1 and 2 of this Specification

F. Masonry Cleaner: Product information

1.4 QUALITY ASSURANCE

A. Testing Service -- The OWNER will engage an independent testing laboratory to perform material evaluation tests and to perform required Special Inspections.

B. Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at any time during the progress of the Work. Allow free access to material stockpiles and facilities at all times. All initial testing required by the Contract Documents shall be done at the OWNER's expense. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

C. Minimum Testing Frequency:

1. An independent testing agency or laboratory shall make test specimens of masonry grout and mortar on job site.

2. One mortar test and one grout test shall be taken for each 5,000 square feet of wall area but at least one set of tests shall be taken.

3. The use of testing and inspection does not relieve the CONTRACTOR of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

D. Inspection Criteria:

1. Masonry construction shall be inspected and evaluated in accordance with the requirements of Chapter 17 of the Oregon Structural Specialty Code, per TMS 402 Table 3.1 – Level 3 Quality Assurance and TMS 602, Table 4 – Level 3 Quality Assurance requirements, unless otherwise indicated.

2. The Contract Documents shall dictate the required level of inspection per above reference or provide a project specific special inspection program.

3. If the Contract Drawings do not specify the level of required inspection, provide Level 3 Quality Assurance, or obtain written direction from the ENGINEER to the required level of inspection.

E. Environmental:

1. The cold weather construction provisions of TMS 602, Article 1.8 C shall be implemented when the ambient temperature falls below 40 degrees F or the temperature of the masonry units is below 40 degrees F.

2. The hot weather construction provisions of TMS 602, Article 1.8 D shall be implemented when the ambient temperature exceeds 100 degrees F or when the temperature exceeds 90 degrees F and the wind velocity is greater than 8 mph.

3. No salt, anti-freeze chemicals or related materials permitted. Store masonry units and bagged materials off ground and protect from rain.

4. Do not build on work having film of water or frost on surfaces.

5. Protect work by covering in rainy weather; protect green masonry from freezing.

6. Before stopping work for day, cover tops of walls at new work with non-staining waterproof covering extended 2 feet minimum down both sides of wall and secured.

F. Delivery, Storage and Handling – Deliver and store packaged materials in original, unopened containers and store in dry weathertight enclosures. Stockpile and handle aggregates to prevent segregation and contamination. Maintain sand for volume proportioning of mortar and grout in a damp loose condition.

PART 2 PRODUCTS

2.1 MORTAR AND GROUT MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C150.

B. Fine and coarse aggregate: ASTM C404 for grout.

C. Sand:

1. Clean, sharp, well graded, and free from salt, loam, clay, and other foreign matter.

2. Sand shall conform to ASTM C144 for mortar.

3. Sand shall be graded as follows:

Sieve Size	Percent Passing
4	100
8	95 – 100
16	70 -100
30	40 – 75
50	15 – 35
100	2 – 15
200	0

D. Lime: Hydrated type conforming to ASTM C207, Type S.

E. Water: Clean, fit for drinking (potable), and free from strong acids, alkalis, oils, or organic material.

F. Waterproofing admixture: Powder.

1. Type: Grace Hydratite Plus, CemMaster Hydrolox 400, BASF Rheomix, BASF Rheopel or approved equal.

G. Accelerator or retardant

1. May be added when required by weather conditions.

2. Type: Anti-Hydro, Grace Dehydratine 80 or Dehydratine 80M, BASF Pozzolith, Sika Plastiment, Sonneborn Sonotard, Trimex, or approved equal.

H. Intrusion (water-reducing) admixture for masonry grout.

1. Type: BASF Pozzolith, IntrusionAid or approved equal.

I. Water-reducing admixture for mortar.

1. Type: BASF Rheomix or approved equal.

J. Mortar Color.

1. Pure natural finely milled inert water insoluble non-bleeding and free of deleterious fillers or extenders.

2. Color shall be as shown on the Drawings.

3. Color shall be selected by OWNER from manufacturer's standard range of colors.

2.2 PROPORTION OF MIXES

A. Mortar

1. Conform to ASTM C270 and be of the type and color specified.

2. Type S with minimum 28-day compressive strength of 1,800 psi minimum.

3. Mixed by volume in ratio of 1-part Portland cement (6 sacks per cubic yard minimum), 1/4 to 1/2-part lime, 2-1/4 to three (3) parts (to cement-lime combined volume) sand.

4. Pointing mortar shall be one part cement, 1/4 lime, three (3) parts sand by volume. Add one (1) pound of water-reducing admix for mortar per bag of cement and one pound per cubic foot of lime.

5. Add waterproofing in amounts recommended by manufacturer, 0.2 pounds of waterproofing per 100 pounds of cement minimum.

6. Do not use admixtures containing more than 0.2 percent chloride ions.

7. Limit the maximum percentage of mineral oxide or carbon black job site pigments by weight of cement as follows: For pigmented Portland cement-lime mortar; 10 percent maximum mineral oxide pigment or 2 percent maximum carbon black pigment.

B. Masonry grout

1. Conform to ASTM C476.

2. Minimum 28 days compressive strength greater than or equal to 2,500 psi, seven (7) sacks of cement minimum per cubic yard.

3. Waterproofing admix and intrusion admix in amounts recommended by manufacturer, 0.2 lb. of waterproofing per 100 pounds of cement minimum.

C. Masonry grout for pouring:

1. Fluid consistency, seven (7) to eight (8) inches slump.

2. Accurately mix by volume 1-part Portland cement: two (2) parts minimum to three (3) parts maximum of damp loose sand: two (2) parts maximum of 3/8-inch minus aggregate.

3. For masonry grout spaces less then three (3) inches in any dimension, omit 3/8-inch minus aggregate.

D. Masonry grout for pumping:

1. Without segregation of the constituent parts.

2. Mixed to a consistency that has a slump between eight (8) to eleven (11) inches.

E. Empty bags for waterproofing and intrusion admixes shall be retained for verification prior to their disposal. Use accelerator or retardant in strict accordance with manufacturer's printed instructions.

2.3 MASONRY CLEANER

A. Sure Kleen #101 Lime Solvent or approved equal.

PART 3 EXECUTION

3.1 MIXING

A. Masonry grout shall be plant batched.

B. Mortar:

1. All tools and equipment used in mixing of mortar shall be clean and free of contaminants.

2. Measure materials by volume or equivalent weight, not by shovel.

3. Supply only as much water as necessary to obtain desired workability; required compressive strength must be met.

4. Mix by placing 1/2 of the water and sand in the operating mixer. Then add the cement, lime and the remainder of the sand and water.

5. After all ingredients are in the batch mixer, they shall be mechanically mixed for not less than three (3) minutes.

6. Hand mixing shall not be employed.

7. Heat aggregates when air temperature is below 32 degrees F to maintain mortar at 70 to 120 degrees F until used.

8. Maintain workability of mortar by retempering.

    a. Retemper by adding only as much water as required to maintain high plasticity.

    b. Retempering shall only be done by adding water within a basin formed from mortar on a mortar board and working mortar into water.

    c. Discard all mortar which has begun to stiffen, or which is unused after 2-1/2 hours from the initial mixing.

3.2 INSTALLATION

A. See Section 04 22 00, Concrete Masonry Units.

B. All masonry shall be laid true straight level, plumb and neatly in accordance with the drawings; lay out in advance so that no concrete unit less than eight (8) inches in length occur except where necessary as in reveals, etc.

C. All units shall be saw cut accurately to fit all openings, and for electrical and plumbing work.

1. No plumbing or electrical boxes or conduit shall be placed in any cell or course that contains reinforcing.

2. All cutting shall be done with masonry saw and produce neat and true surface.

D. All units shall be sound, dry, clean, and free from cracks and chips.

E. No construction supports shall be attached to the wall except where specifically permitted by the ENGINEER.

F. Units shall be “air” dry at time of laying.

3.3 REINFORCEMENT

A. Refer to Section 03 21 00, Reinforcing Steel.

B. The following minimum requirements shall be met unless shown otherwise:

1. Provide #5 verticals at four (4) feet maximum on center.

2. Locate two #5 at each jamb of door, window, louver, and other openings and end of walls; run full height of wall. Reinforcement adjacent to openings need not be provided for

openings smaller than 16-inches in either the horizontal or vertical direction, unless the spacing of distributed reinforcing is interrupted by such openings.

3. Position two #5 vertical at each wall corner and each wall intersection; run full height of wall.

4. Dowel verticals to foundation with one #5 dowel four (4) feet long minimum per vertical; embed dowel two (2) feet in foundation unless otherwise shown on drawings.

5. Horizontal reinforcement, unless shown otherwise, shall be two #4 rebars in the bond beams which are located at four (4) feet maximum on center and at all floor and roof levels. Bend rebar at corners and intersections, or supply two (2) feet by two (2) feet rebar of same size and number as horizontal reinforcement. Horizontal reinforcement shall be anchored around vertical reinforcing bars with a standard hook at all wall ends, corners, and intersections that are not continuous around the corner or through the intersection. For openings, minimum lintel size and reinforcement shall be two (2) #4 rebars in bottom of 8-inch lintel for less than four (4) feet span, and two (2) #5 rebars in bottom of 16 inches lintel for four (4) feet to 10 feet span. Lintel reinforcement to extend two (2) feet beyond each side of jamb.

6. Before placing reinforcement remove mud, oil, mills scale, loose rust, ice, and any other coatings from it. Position reinforcement accurately; center in cells unless noted otherwise. Secure against displacement, holding vertical reinforcement firmly in place by means of frames, rebar spacers, or other suitable devices, and place horizontal reinforcement as laying progresses. Vertical bars shall be held in position at the top and bottom and at intervals not exceeding 192 diameters of the reinforcement.

7. Minimum clear distance between longitudinal bars shall be nominal diameter of bar or 1-inch, whichever is larger. Minimum thickness of mortar or grout between masonry and reinforcement shall be 1/4-inch for fine grout and 1/2-inch for coarse grout. Unless noted otherwise, reinforcing bars and dowels shall be lapped 40 bar diameters or 2-foot six (6) inches minimum, where spliced end shall be separated by 1 bar diameter or wired together.

8. Splice reinforcement only at points shown on Drawings or reviewed shop drawings; any other locations must be specifically reviewed by ENGINEER.

    a. Splices in adjacent bars shall be staggered; in horizontal reinforcement of walls separate at least 10 feet longitudinally for bars of same tier.

    b. Splices in reinforcement shall be made only at such points and in such a manner that the structural strength of the member will not be reduced.

    c. Lapped splices shall provide sufficient lap to transfer the working stress of the reinforcement by bond and shear.

    d. Minimum lap shall be 40 bar diameters, where spliced end shall be separated by 1 bar diameter or wired together.

    e. Welded or mechanical connections shall develop the full yield strength of the reinforcement.

f. Bond beams shall be continuous around corners.

9. When a foundation dowel does not line up with a vertical core, it shall not be sloped more than one horizontal in six vertical. Dowel shall be grouted into a core in vertical alignment, even though it may be in cell adjacent to cell holding vertical wall reinforcing.

10. Bond beam reinforcement shall be laid continuously on webs of bond beam units. Intersecting masonry walls shall be tied to one another by horizontal reinforcement, unless noted otherwise; where masonry walls intersect with concrete walls, connect with 1/2-inch diameter by 15-inch mechanical bolts in flush shells at bond beams.

11. To allow bonding masonry, clean laitance from top of concrete foundation before proceeding. The stating joint on foundations or slabs shall be laid with full mortar coverage except at the area where grout occurs, which shall be kept free of mortar so that grout is in contact with the foundation slabs.

12. Lay units in regular running bond except where soldier or other coursing is shown on drawings; maintain even module. Corners shall have same masonry bond by overlapping units. Joints shall be uniform throughout all work having same type of masonry units.

13. At running bond, thread vertical reinforcing through alternately overlapping cells. Lay units according to "face and shell" method; provide full mortar coverage on all face shells, and on faces and webs surrounding vertical and horizontal cells to be filled with grout.

14. Do not furrow bed joints. Shove tightly each new unit against existing unit so that mortar bonds well to both.

15. Rock closures into place. Do not pound corners and jambs to fit stretcher units after they are set in position. Remove all excess grout and mortar spilled on masonry units during construction.

16. Dry brush all masonry surfaces at end of each day's work. Stop off horizontal run of masonry by racking back one-half length of unit in each course at end of day's work. Toothing is not permitted. Where fresh masonry joins partially set masonry, remove loose units and mortar clean and then lightly wet exposed surface of set masonry before starting new work.

17. Joints of walls to be covered or furred may be left flush, without tooling. Joints of all walls which are to be exposed shall be tooled when "thumb right" hard mortar is partially set but still sufficiently plastic to bond) with round jointer or bar to produce a dense, slightly concave surface, well bonded at edges. All tooling shall be done with a tool which compacts the excess mortar out of joint rather than dragging it out. Joints which are not tight at the time of tooling shall be raked out, pointed, then tooled. If it is necessary to move to a unit after it has been once set in place, the unit shall be removed from wall, cleaned, and set in fresh mortar. Remove any mortar fins from joint junctions.

18. Unless shown otherwise on drawings, provide 8-inch lintel for concrete masonry openings four (4) feet wide or less and 16-inch lintel for openings greater than four (4) feet wide. Forms and shores for lintels shall be substantial. Brace or tie forms to maintain position and shape. Forms shall be tight with no leakage of mortar or grout. Do no remove forms

and shores until masonry has hardened sufficiently to carry its own weight and other temporary loads that may be placed on it during construction, 10 days minimum.

3.4 MASONRY GROUTING

A. Masonry grouting shall be by low lift method.

1. The repetitive construction procedure of erecting a masonry wall to a height not greater than four (5) feet, grouting the wall as required and then repeating this cycle until the top of the wall is reached shall be classified as low-lift grouting. Grout shall be placed while mortar joints are still soft and plastic or the grout spaces shall be cleaned of mortar dropping and protruding mortar joints shall be removed.

B. Cells containing reinforcement or embedded items shall be solidly filled with grout. Before grouting starts, reinforcing steel shall be secured in a place and observed by ENGINEER and inspected by Building Inspector from governmental unit having authority.

C. Vertical cells to be filled shall have vertical alignment to maintain continuous unobstructed cell area. To confine grout to horizontal masonry beams, the tops of unfilled cell cavities or cores in masonry units under beams shall be covered with metal lath, or special bond beam or lintel units shall be used, or another method may be employed if approved by ENGINEER, building paper shall not be permitted.

D. All bolts, anchors, etc., inserted in walls shall be fully and solidly grouted in place. Embedment shall not be less than 3/4 of the wall thickness, unless otherwise noted.

E. Masonry shall cure at least 24 hours before grouting. Keep clean of mortar and drippings those cavities and cores which are to be grouted. Mortar projections and droppings shall be washed out of spaces and off reinforcing with a jet stream of water.

F. Masonry grout shall be poured in lifts not exceeding five (5) feet. All masonry shall be laid using the Low-Lift grouting method with maximum grout pour heights not to exceed five (5) feet unless otherwise allowed in writing by the ENGINEER. In addition, grout pour heights shall not exceed the maximum grout pour height limits of Table 6 of TMS 602, based upon the minimum grout space dimensions for grouting of cells of hollow units. Lay masonry until location of a bond beam or horizontal lintel beam is reached, but not to exceed the limits of Table 6 of TMS 602, and then grout full the vertical cells required to be grouted and fill the beam or lintel without pause.

G. To ensure complete filling of grout space, consolidate grout at time of pouring by puddling and then reconsolidate by later puddling before the plasticity is lost. Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

H. Solid grout hollow metal door and window frames; for all wall openings over two (2) feet wide, solid grout from lintel to floor or roof above in one continuous operation.

I. Place grout within 1 1/2 hour from introducing water in the mixture and prior to initial set.

3.5 MASONRY CLEANING

A. All mortar and grout must be thoroughly set and cured before cleaning. Remove excess mortar or mortar stains or efflorescence; scraping devices shall be nonferrous. Protect all adjacent surfaces, including sash and other corrodible metalwork, from damage by cleaning solvent.

B. Saturate all exposed masonry with water immediately before cleaning, apply solution of cleaner as per manufacturer's instructions and rinse thoroughly with fresh, clean water immediately after cleaning. Do small sections at a time, working from top to bottom. Repeat as necessary.

C. Tuckpoint any loose or defective mortar joints. At conclusion of masonry work, remove scaffolding and equipment used in work and remove debris, refuse and surplus masonry material.

END OF SECTION

SECTION 04 22 00 - CONCRETE MASONRY UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Work included under this section shall include all materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to complete the work, including, but not limited to, these major items:

1. Concrete masonry units.

2. Vertical and horizontal reinforcing and dowels projecting into subsequently placed concrete.

3. Setting of flashing and other work to be embedded in masonry.

1.2 RELATED SECTIONS:

1. Section 03 21 00, Reinforcing Steel.
2. Section 04 05 17, Masonry Mortar and Grout.

1.3 SUBMITTALS

A. Samples -- Before any concrete unit masonry materials are delivered to the job site, submit one sample of each proposed concrete masonry unit.

B. Submit color samples for OWNER selection of concrete masonry unit colors.

C. Material Certificates -- Prior to delivery of concrete masonry materials, anchors, ties, fasteners, and metal accessories to the job site, deliver a letter from the manufacturer of the proposed masonry units, anchors, ties, fasteners, and metal accessories certifying that all such units to be delivered to the job site are in strict conformance with the provisions of this Section.

D. Construction procedures for Cold Weather Construction and/or Hot Weather Construction for review and approval by OWNER in compliance with the requirements herein prior to use on the project.

E. A letter of certification from the Supplier of the materials prior to delivery of the materials to the site to verify f'm according to the Chapter 17 of the International Building Code (IBC).

1.4 QUALITY ASSURANCE

A. Qualifications of Workers

1. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

2. Provide one skilled journeyman mason who shall be present at all times during execution of this portion of the work and who shall personally direct all work performed under this Section.

B. Standards, Specifications and Codes

Comply with the applicable provision of the following codes, specifications and standards to the extent indicated by reference thereto:

1. American Concrete Institute (ACI)
2. American Society of Testing and Materials (ASTM)
3. National Concrete Masonry Association (NCMA)
4. Structural Clay Products Institute (SCPI)
5. American Society of Civil Engineers (ASCE)
6. The Masonry Society (TMS)
7. The International Building Code (IBC)

Comply with building code requirements which are more stringent than the above and all O.S.H.A. requirements.

C. Testing Service -- The OWNER will engage an independent testing laboratory to perform material evaluation tests and to perform required Special Inspections.

D. Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. All testing required by the contract documents shall be done at the OWNER's expense. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

E. Inspection Criteria:

1. Masonry construction shall be inspected and evaluated in accordance with the requirements of Chapter 17 of the Oregon Structural Specialty Code per TMS 402 Table 3.1 – Level 3 Quality Assurance and TMS 602, Table 4 – Level 3 Quality Assurance requirements, unless otherwise indicated.

2. The Contract Documents shall dictate the required level of inspection per above reference or provide a project specific special inspection program.

3. If the Contract Drawings do not specify the level of required inspection the CONTRACTOR shall provide Level 3 inspection or obtain written direction from the ENGINEER to the required level of inspection.

F. Minimum Testing Frequency:

1. An independent testing agency or laboratory shall verify the compressive strength (f'm) of the proposed construction prior to construction and at regular intervals during construction as indicated in the Contract Documents, but at least one test for every 5,000 square feet during construction.

2. The compressive strength (f'm) shall be determined for each wythe of multiwythe walls.

3. Unless specifically directed within the Contract Documents, use the unit strength method specified by TMS 602.

4. The use of testing and inspection does not relieve the CONTRACTOR of the responsibility to furnish materials and construction in full compliance with the

1.5 PRODUCT HANDLING

A. Store materials under cover in a dry place and in a manner to prevent damage or intrusion of foreign matter. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store masonry units under covers that will permit circulation of air and prevent excessive moisture absorption. Protect concrete masonry units from wetting.

B. Handle unit on pallets or flatbed barrows.

C. Replacements -- In the event of damage, immediately make all repairs and replacements necessary to the approval of the OWNER and at no additional cost to the OWNER.

D. Reinforcing, metal ties, and anchors shall be protected from contact with soil and water and before being placed shall be free of loose rust and other coatings that will reduce or destroy bond.

E. Environmental Conditions - Implement the following special construction procedures based on the environmental conditions encountered during masonry construction. Failure to maintain the conditions specified below during the construction of masonry work will be just and sufficient cause for such work to be rejected.

1. Cold Weather - The cold weather construction provisions of TMS 602, Article 1.8 C shall be implemented when the ambient temperature falls below 40 degrees F or the temperature of the masonry units is below 40 degrees F. All masonry units and all work on which new masonry is constructed shall be free of frost, ice, snow, and surface moisture and their temperature shall not be lower than 40 degrees F. Protect green masonry from freezing. No salt, anti-freeze chemicals or related materials are permitted.

2. Hot Weather - The hot weather construction provisions of TMS 602, Article 1.8 D shall be implemented when the ambient temperature exceeds 100 degrees F or when the temperature exceeds 90 degrees F and the wind velocity is greater than 8 mph.

3. Wet Weather - Store masonry units and bagged materials off ground and protected from rain. Do not build on work having a film of water on any surfaces. Protect work by covering in rainy weather. Before stopping work for the day, cover the tops of walls at new work with non-staining, waterproof covering extended 2 feet minimum down both sides of wall and secured in place.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. One-sided, exterior facing, split face concrete block.

B. Unit shall be in modular sizes. Exposed-to-view units in anyone building shall be of the same appearance. The texture of units shall match the approved samples for the types of construction and locations designated on the plans. Units shall not contain iron spots or other substances that will stain plaster or paint.

C. Hollow load-bearing units shall conform to ASTM C90 type 1, Grade N.

D. The composition shall be 50 percent lightweight (pumice) and 50 percent sand. The lightweight aggregate shall conform to ASTM C331 and the sand shall conform to ASTM C33.

E. Minimum compressive strength of all blocks shall be 2,000 psi based on the net area.

F. Maximum water absorption permitted for units at the time of delivery to the job site shall be 13 pounds per cubic foot (13 pcf) of concrete as an average of three units for normal weight aggregate per ASTM C140.

G. Maximum moisture content permitted for standard weight aggregate units at time of delivery shall be 30 percent of total absorption. The tests for moisture content shall be determined from an average of five units per ASTM C140.

H. Maximum linear shrinkage shall not exceed 0.065%. Concrete masonry units shall include lintel, and bond beam units, and special shapes and sizes required to complete the work indicated.

I. Certification required above shall show results of tests made not more than 12 months prior to delivery of concrete masonry units to the job site, shall show compliance with the specified values, and shall certify that the mix design, yield per batch, and curing procedures for the units delivered to the job site will be equal to those submitted for the test.

J. Unit Colors. Pure natural finely milled inert water insoluble non-bleeding and free of deleterious fillers or extenders. Colors shall be as shown on the plans. Colors shall be selected by OWNER from manufacturer's standard range of colors.

2.2 MORTAR AND GROUT

Provide mortar and grout as indicated on the drawings in conformance with the requirements of Section 04 05 17, Masonry Mortar and Grout, of these specifications.

2.3 REINFORCEMENT STEEL

Provide reinforcement steel as indicated on the drawings and in conformance with the requirements of Division 3 of these specifications and of Section 04 05 17, Masonry Mortar and Grout.

2.4 OTHER MATERIALS

All other materials, not specifically described but required of a complete and proper installation of the work of this Section, shall be as selected by the CONTRACTOR subject to the approval of the OWNER.

PART 3 EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this Section.

3.3 INSTALLATION

A. Masonry shall be plumb, true to line, with level courses accurately spaced, and built to thickness and bond pattern indicated. Where no pattern is indicated, masonry shall be laid in running bond pattern. Concrete masonry units shall be dry when laid. Each unit shall be adjusted to final position in the wall while mortar is still soft and plastic. Any unit disturbed after mortar has stiffened shall be removed and re-laid with fresh mortar. Chases shall be built in and not cut in. Chases shall be plumb and shall be minimum one unit length from jambs of openings. Chases and raked-out joints shall be kept from mortar or debris. Spaces around metal door frames and other built-in items shall be solidly filled with mortar as each course is laid. Anchors, wall plugs, accessories, flashings, and other items to be built in shall be installed as the masonry work progresses. All cutting and fitting of masonry, including that required to accommodate the work of other sections shall be done by masonry saws.

B. Where fresh masonry joins masonry that is partially set or totally set, clean the exposed surface of the set masonry, and remove all loose mortar. If it is necessary to “stop off” a horizontal run of masonry, this shall be done by raking back one-half brick or block length in each course. Toothing will not be permitted.

C. Before closing up any pipe, duct or similar inaccessible spaces or shafts with masonry, remove all rubbish and sweep out the area to be enclosed.

D. Provide level and solid bearing in masonry walls under all bearing structural floor and roof elements. Solid bearing shall be bond beams unless otherwise indicated.

E. All masonry walls shall extend to underside of floor beams or roof metal decking unless otherwise indicated.

F. If blowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt at no additional cost to the OWNER.

G. Mortar Beds and Joints

1. Hollow units shall be laid with full mortar coverage on horizontal and vertical face shells, except that webs shall be also be bedded in all courses of the starting course on footings and solid foundation walls, and where adjacent to cells or cavities to be reinforced and/or filled with grout or concrete.

2. Horizontal and vertical face joints shall be 3/8-inch thick unless otherwise indicated. Vertical joints shall be shoved tight. Mortar joints in exposed or painted surfaces shall be tooled when thumbprint hard to a flush joint. Joints in unparged masonry below grade shall be pointed tight with a trowel. Mortar joints in surfaces to be plastered, stuccoed, or covered with other masonry shall be cut flush. Mortar protrusions extending into cells or cavities to be reinforced and filled shall be removed.

H. Placing Reinforcement

1. Place reinforcing as covered in Section 04 05 17 – 3.3, Masonry Mortar and Grout, of these specifications.

    a. Vertical reinforcement shall be rigidly secured at the top and bottom of CMU wall and at intervals necessary to hold the reinforcing in proper position.

    b. Reinforcement shall be placed at the wall centerline unless indicated otherwise.

I. Low-Lift Grouting

1. Place reinforcing as covered in Section 04 05 17 – 3.4, Masonry Mortar and Grout, of these specifications.

    a. Set steel lintels in beds of mortar. Fill spaces around jambs and head of metal door buck and frames solidly with mortar.

J. Pointing and Cleaning

1. At the completion of the work, all holes in joints of masonry surfaces to be exposed or pointed except weep holes shall be filled with mortar and suitably tooled, masonry walls shall be dry brushed at the end of each day's work and also final pointing, and shall be left clean and free from mortar spots and droppings. Any cracks in masonry shall be repaired. Defective joints shall be cut out and repointed.

2. Remove efflorescence, mortar spots and other areas that appear unclean with cleaning agent to a sample wall area as directed by the OWNER. The OWNER retains the right to change proposed cleaning methods and shall be notified before any additional cleaning agent is used. The cleaning methods agent shall be applied to a small section of the wall at a time and work shall proceed from the top to the bottom. Protect all metal sashes, lintel, louvers, and other corrodible parts when masonry is cleaned.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Provide structural steel members, including all anchor bolts and other devices required for installation.

B. Shop fabricate miscellaneous steel and iron work, including brackets, braces, angles, lintels, anchors, supports, or other items shown on Drawings for support or connection of other work.

C. Furnish items to other trades when setting and installation is part of their work.

D. A list of items needed for the construction of the building are herein specified and constitutes a description of the type of materials necessary to fabricate such items. However, this does not imply that each individual item on the job is herein listed.

E. Structural steel members which will remain exposed to view shall comply with additional requirements of Division 5 Section "Architecturally Exposed Structural Steel."

1.2 REFERENCES

A. The American Institute of Steel Construction (AISC).
B. American Society for Testing and Materials (ASTM).
C. The American Welding Society (AWS).
D. The Society for Protective Coatings (SSPC).

1.3 SUBMITTALS

A. Shop drawings detailing fabrication of structural steel components.

B. Cross reference shop drawing details to detail numbers on the Drawings to facilitate checking.

C. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

D. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

E. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

F. Provide AWS certificate copy for all welders. Submit to Architect prior to fabrication.

G. Welding procedure specifications (WPS) for all different welding types and fit-ups.

H. Provide mill certificates attesting to grades of structural steel, steel tubing and pipe.

1.4 DELIVERY STORAGE AND HANDLING

A. Store material at the project site above the ground on platforms, skids or other supports, and protect from corrosion. Store nuts, bolts, washers, grout, welding rods and other materials in weathertight and dry location. Keep packaged materials in original, unbroken containers.

B. Structural steel at job site without inspection certificate or erection marks will be rejected.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes: ASTM A36, or ASTM A572 Grade 50 where indicated, standard rolled sections of size and weight fabricated as detailed.

1. W and WT Shapes: ASTM A992, Grade 50.
2. Other Rolled Shapes: ASTM A36.
3. Structural Steel Plates and Bars: ASTM A572, Grade 50.
4. Square and Rectangular HSS: ASTM A500, Grade C (Fy = 50ksi).

B. Ledgers, Angle Frames, Headers, and Blocking: ASTM A36, standard rolled section of size and weight fabricated as detailed.

C. Plates, Clips, Hangers and Brackets: ASTM A36, or ASTM A572 Grade 50 where indicated, standard rolled shapes and sections fabricated to sizes and dimensions as detailed.

D. Anchor Rods, Bolts, Screws, Nuts and Washers:

1. Headed Rods: ASTM F1554, Grade 55, as noted

2. Headed Bolts: ASTM A325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.

3. Bolts: ASTM A325 bolts for structural bolting and ASTM A307 bolts where noted as machine and anchor bolts.

4. Screws: ASTM C954, No. 10 diameter by length required to penetrate steel flange by not less than 3 exposed threads and with polymer coating.

5. Nuts and Washers: Nuts and washers for all bolted connections. ASTM A36.

6. Finish: Hot-dip galvanized finish ASTM A153 Class C when installed with galvanized items.

E. High-Strength Bolts, Nuts and Washers: ASTM A325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Hot-dip zinc-coating, ASTM A153, Class C, unless noted otherwise.

F. Expansion Bolts for Structural Steel: Pre-assembled bolt assembly consisting of a bolt, expansion sleeve, and cone-shaped nut.

1. Description: Zinc plate finish at interior exposure, stainless steel at exterior exposure.
2. Manufacturers: “Hollo-Bolt” by Lindapter, or engineer approved equal

G. Welding Electrodes: Comply with AWS requirements.

H. Mechanical Screw Anchors:

1. Description: Zinc plate finish at interior exposure, stainless steel at exterior exposure.
2. Manufacturers: "Titen HD" by Simpson Strong-Tie, or engineer approved equal

I. Threaded Concrete Anchors:

1. Description: ASTM F1554 Grade 50 at interior exposure, ASTM F593 Group 1-CW1 Type 316 at exterior exposure

J. Epoxy Concrete Anchors:

1. Description: Zinc plate finish.
2. Manufacturers: "HIT RE-500" by Hilti or engineer approved equal.

2.2 FINISHES

A. Hot-dip galvanized finish ASTM A123, Coating Grade 60, for all steel and iron items exposed in exterior locations, and elsewhere as detailed, except for steel scheduled to receive "special paint," shall be primed with Tnemec "90-97" or Carboline "859" at 3 mils dry film thickness after being surface prepared in accordance with SSPC SP-6. One shop coat rust inhibiting primer paint on all other items whether concealed or exposed, except do not prime surfaces to be bonded into concrete or masonry, at friction-type bolted connections, surfaces within 2-inches of bolts or welds, or surfaces to receive shear studs.

2.3 FABRICATION

A. Incorporate minimum reference standard for fabrication and erection; AISC Specifications.

B. Cut shapes to pattern, sizes, and dimensions as detailed and approved. Punch and drill holes accurately, maintaining proper edge and end clearance and proper diameter to fit each fastening. Countersink holes for flat head wood screws.

C. Camber structural steel members where indicated.

D. Remove rust, scale, grease and oil after fabrication and prime paint.

E. Furnish and shop assemble all items true to measurements taken at the job, disassembled and ship to the job, complete with all sleeves, bolts, etc., necessary for erection.

F. Mark each member or assembly of members with erection marks for identification; furnish an erection diagram with marks shown. Load structural members or assembled units in such a manner that they may be transported and unloaded without being excessively stressed, deformed or otherwise damaged. Place fabricated material on skids, off the ground; keep clean and properly drained.

G. All welding performed by certified welders and in accordance with AWS Code. Grind welds on architecturally exposed items to make smooth and flush when ready for paint finish.

H. Grind exposed ends and cut edge of all items smooth and slightly beveled to remove sharpness, burrs, and cutting marks. Use gas cutting torch in the field to cut holes or correct fabrication errors only after submitting each condition to Architect for review.

PART 3 EXECUTION

3.1 ERECTION

A. Comply with the AISC Specifications and Code of Standard Practice, with specified requirements.

B. Use special care in unloading, handling, and erection, to avoid bending, twisting, or otherwise distorting the members. Plan and execute the erection in such a way that the close fit of the joints and the structure as a whole will not be impaired.

C. Do not set permanent bolting or welding until as much of the structure as will be stiffened thereby has been properly aligned and within tolerances.

D. At completion of erection, touch-up paint bolts and field welds and abrasions with the same paint used for shop painting. Repair galvanized steel in accordance with ASTM A780.

3.2 FIELD ASSEMBLY

A. Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of the structure within AISC tolerances.

B. All beams and girders shall be cambered as indicated on the Drawings. Where no camber is specified, natural camber of the member shall be up, opposite for cantilevers.

C. Splice members only as detailed or specified.

D. Provide temporary bracing where necessary to take care of loads to which the structure may be subjected, including erection equipment, and its operation. Leave bracing in place as long as may be required. Concrete walls and floors are required for stability of the steel frame.

E. Bolt using high-strength threaded fasteners. Assemble in accordance with AISC Specification for Structural Joints, including Supplement No. 1, March 11, 1986, using ASTM A325 bolts.

F. Install expansion bolts for structural steel per manufacturers installation instructions and follow all recommendations provided therein.

G. Provide angle frame headers and blocking (or other standard shapes if detailed otherwise) at steel deck penetrations, sized for span and dead/live loading to match adjacent deck loading design.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections: The Owner will employ the services of an independent testing laboratory for performing tests and to conduct inspection services on all shop fabricated and on-site structural welding and bolting plus expansion anchor, grouted anchor, and adhesive anchor placement required for this construction.

END OF SECTION

SECTION 05 12 13 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. This specification applies only to members which will remain exposed to view, and which shall be fabricated, handled, and erected as directed in this Specification and, except as noted below, in conformity with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" and AISC "Standard Code of Practice, Section 10." Because these members so designated are subject to close inspection by the public, the fabrication tolerances in this Specification shall govern when such tolerances are in conflict with those of the AISC Specification.

B. All requirements of Division 5 Section "Structural Steel Framing" apply to this Section except where exceeded by the requirements of this Section.

1.2 REFERENCES

A. The American Institute of Steel Construction (AISC).
B. American Society for Testing and Materials (ASTM) A6.
C. The American Welding Society (AWS).

1.3 SUBMITTALS

A. Submit the following in accordance with Division 1 Section "Submittal Procedures."

B. Shop drawings of architecturally exposed structural steel components. Cross reference shop drawing details to detail numbers on the Drawings to facilitate checking.

PART 2 PRODUCTS

2.1 MATERIALS

A. Material shall be the same as specified for structural steel by the AISC Specification.

B. Permissible tolerances for out of square or out of parallel, depth, width, and symmetry of rolled shapes shall conform to ASTM A6. Overall profile dimensions of built-up members shall be adequate to provide for the accumulated permissible overrun of the component parts.

C. The as fabricated straightness tolerances of members shall not exceed one half of the standard camber and sweep tolerances in ASTM A6.

D. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 FABRICATION

A. General:

1. Perform fabrication with special care and necessary straightening to maintain the condition of the material as described below.

2. Shop drawings shall clearly show the required fabrication tolerances. Erection plans and anchor bolt shop drawings shall show the required tolerances for setting embedded items.

3. All copes, miters, and butt cuts in surfaces exposed to view shall be made with uniform gaps of 1/8 inch if detailed to be open joints, or in uniform contact if shown without gap.

4. Where the fit up of adjacent members is such that permissible tolerances specified in the preceding paragraphs may result in an unsightly joint, the Architect shall specify on the Drawings the tolerances required. Maintain tolerances with special attention to detailing the joint or, if necessary, by refined fabrication techniques.

5. Remove mill stamps by grinding. Fill low spots and sand smooth to match adjacent surfaces.

6. Remove all temporary fabrications including crane hooks that would be exposed to view in their final assembly. Repair damage to exposed surfaces to match adjacent surfaces.

B. Welding:

1. Fillet Welds: Faces of welds exposed to view shall have as welded surfaces that are reasonably smooth and uniform. No finishing or grinding shall be required except where clearances or fit of other items may so necessitate, or as specifically detailed.

2. Butt and Plug Welds: Faces of butt and plug welds exposed to view shall have as welded surfaces that are reasonably smooth and uniform and shall not project more than 1/16 inch above the surfaces joined. No finishing or grinding shall be required except where clearances or fit of other items may so necessitate, or as specifically detailed.

C. Prime Painting:

1. Comply with Division 5 Section "Structural Steel Framing" finish requirements for Paint System D.

2. Surfaces within 2 inches of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done. If shop painted, surfaces to be welded shall be wire brushed in the field before welding to reduce the paint film to a minimum.

PART 3 EXECUTION

3.1 ERECTION

A. Use special care in unloading, handling, and erecting the steel to avoid bending, twisting, or otherwise distorting the steel members. Handle the material in such a way as to minimize the damage to shop coat of paint.

B. Plan and execute the erection in such a way that the close fit and neat appearance of the joints and the structure as a whole will not be impaired.

C. If temporary braces or erection clips are employed, avoid any unsightliness upon removal. Grind smooth all tack welds, fill all holes with weld metal or body solder, and smooth by grinding or filing.

END OF SECTION

SECTION 05 31 23 - STEEL ROOF DECKS

PART 1 GENERAL

1.1 SECTION INCLUDES

Roof Decks; Steel:

1. Profile: Type B-36.

1.2 RELATED SECTIONS

A.

Section 03 30 00 – Cast-In-Place Concrete Work
Section 05 12 13 - Architecturally-Exposed Structural Steel Framing.
Section 05 50 00 - Metal Fabrications.

A. Section 09 90 00 - Painting and Coating.

B.

C.

1.3 REFERENCES

D.

American National standards institute (ANSI):

A.

1. ANSI/SDI-RD - Standard for Steel Roof Deck.

American Welding Society (AWS):

B.

1. AWS D1.3 - Structural Welding Code-Sheet Steel.

C. ASTM International (ASTM):

1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

2. ASTM A1063/A1063M - Standard Specification for Steel Sheet, Twin-Roll Cast, Zinc-Coated (Galvanized) by the Hot-Dip Process.

3. ASTM A 1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

4. ASTM A 1039/A1039M - Standard Specification for Steel, Sheet, Hot Rolled, Carbon, Commercial, Structural, and High-Strength Low-Alloy, Produced by Twin-Roll Casting Process.

5. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

6. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

7. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

8. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

9. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

International building Code (IBC):

1. IBC 1704 - Structural Tests and Special Inspections.
2. IBC 1705 - Statement of special inspections.

1.4 DEFINITIONS

A. ASD - Allowable Strength Design (ASD) method.
B. LRFD - Load and Resistance Factor Design method.
C. TSW - Top Seam Welds.
D. BP - Button Punch.

1.5 SUBMITTALS

Submit under provisions of Section 01 33 00 – Submittal Procedures.

A. Product Data: For each type of decking specified, including dimensions, components, profiles, and finishes.

B. Shop Drawings: Layout of decks, anchoring, reinforcing, openings, joints, accessories, and attachments details.

C.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section shall be supplied by a single manufacturer with a minimum of ten years' experience in the manufacture of steel deck.

B. 1. Manufacturer offering deck products must be a member of the Steel Deck Institute.

A. Installer Qualifications: Minimum two years' experience installing similar products.

1.7 DELIVERY, STORAGE, AND HANDLING

B. Deliver products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

C. Store products in clean, dry, sheltered area off the ground until ready for use.

D. Protect products from exposure to direct sunlight and rain.

Handle materials to avoid damage.

1.8 PROJECT CONDITIONS

Maintain environmental conditions, temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 PRODUCTS

A.

2.1 MANUFACTURERS

Acceptable Manufacturer: Vulcraft/Verco Group, which is located at: 6610 CR 60; St. Joe, IN 46785; Email: request info; Web: http://www.vulcraft.com | http://www.vercodeck.com

A. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Characteristics: Calculated per AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.3 ROOF DECKS; STEEL

A. Profile: Type B. Grade 50 steel.

1. Sidelap: PLB-36 Deck used with PunchLok II System.
2. Sidelap: HSB-36 Deck used with TSWs or BPs.
3. Sidelap: HSB-36-SS Deck used with Side-lap Screws.
4. Structural roof deck, providing vertical load and diaphragm shear capacity. The wide rib profile is ideal to uniformly support roofing systems applied on top of deck. Typically used for span conditions of 10 feet (3048 mm) or less.
    a. Rib Depth: 1.5 inch (38 mm).
    b. Width: 36 inches (914 mm).
    c. Edges: Male and female, creating an interlocking side lap when installed.
5. Standards Compliance:
    a. ASTM A653 SS GR50 minimum.
        1) Zinc Coating: G60 or G90.
    b. ASTM A1008 SS GR50 minimum.
    c. IAPMO UES ER-2018.
    d. ANSI/SDI RD-2017.
6. Standard Lengths: 6 to 40 ft (1829 mm to 12192 mm).

7. Thickness: 20 gage. 0.0359 inches (0.912 mm).

2.4 SIDELAP ATTACHMENT

VSC2 connection made on interlocking deck sidelaps with the Vulcraft/Verco Group PunchLok II Tool at spacing designated on the approved installation drawings.

A. Self-Drilling Corrosion Resistant Hex Washer Head Screws: Deck may be installed with short leg on the top or underside. The minimum edge distance for screw must be 1-1/2 times the shank diameter of the screw.

B.
1. No 10 screws spaced at 4" on center.

Arc Seam Welds: 3/8 x 1 in (10 x 25 mm) spaced at 4" on center.

2.5 DECK ATTACHMENT

C.

Deck attachment pattern will be as indicated on drawings. Attachment pattern will provide sufficient strength to resist shear due to lateral loading and wind uplift.

A. Hilti Fasteners:

B.
1. Substrate Thickness: 1/8 in (3 mm) minimum, to 3/8 in (10 mm) maximum.
    a. Hilti X-HSN 24 Fastener: Dome style head, red guidance washer and 0.472 inch (11.99 mm) diameter steel silver-colored top-hat washer.
2. Substrate Thickness: 1/4 in (6 mm) minimum.
    a. Hilti X-ENP-19 L15 Fastener: Fully knurled tip and tapered shank fitted with two 0.590 in (14.99 mm) diameter steel cupped washers.

C. Pneutek Fasteners:

1. Pneutek fasteners have 1/2 in (13 mm) diameter heads and must be driven with the Pneutek Air/Safe fastening system to ensure tight contact between the fastener head and attached deck.
2. Substrate Thickness: 0.113 in (2.87 mm) minimum, 0.155 in (3.94 mm) maximum.
    a. Pneutek SDK61.
3. Substrate Thickness: 0.155 in (3.94 mm) minimum, 0.250 in (6 mm) maximum.
    a. Pneutek SDK63.
4. Substrate Thickness: 0.187 in (4.75 mm) minimum, 0.312 in (8 mm) maximum.
    a. Pneutek K64.
5. Substrate Thickness: 0.281 in (7 mm) minimum.
    a. Pneutek K66.

Self-Drilling Screws compliant with ASTM C1513:

1. No. 10 self-drilling, self-tapping screws.
2. Minimum Support Attachment Thickness: 0.0538 in (1.4 mm)

Welding:

D.

1. Arc Spot Welding:

   a. Decking Welded to Supports: Visible weld diameter, 3/4 in (19 mm) minimum for arc spot (puddle) welds.

E.

2. Arc Seam Welding:

   a. Required at support locations adjacent to the sidelap.
   b. Visible Weld Size (WxL): 3/8 x 1 in (9 x 25 mm) excluding circular ends of welds.

2.6 ACCESSORIES

Miscellaneous Sheet Metal Items Conforming to ANSI/SDI RD:

A.

1. Sump Pans, Sump Plates, Valley Strips, Eave Strips, Edge Closures, Cell Closures: Fabricated of metal of same type and finish as deck. Galvanized unpainted steel may be used in lieu of primer painted accessories with primer painted steel deck.

B. Profile Closures: As shown on the design drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A.

B. Do not install roof deck until supporting construction is in place.

C. Examine support framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work of this section.

A. If supporting construction is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

B.

3.2 PREPARATION

A. Verify that surfaces to receive roof deck are free of debris.
Place deck in accordance with approved installation drawings.
Locate deck bundles to prevent overloading of support members.

3.3 INSTALLATION

Install and fasten deck and accessories in accordance with the Contract Documents, approved installation drawings, manufacturer's documented instructions and requirements of ANSI/SDI-RD or ANSI/SDI C as applicable.

1. Welds shall comply with AWS D1.3.

Place deck panels on structural supports and adjust to final position with ends aligned. Attach firmly to the supports immediately after placement in order to form a safe working platform.

Cut and neatly fit and reinforce deck units and accessories around openings and other work projecting through or adjacent to the decking as shown on the construction drawings.

B. End Bearing: Install deck ends over supports with a minimum end bearing as shown on the installation drawings.

C. Deck End Laps: Where specified on the plans install deck end laps as shown on the installation drawings.

D. Side Closures: Fasten to supporting structure and deck in accordance with the Contract Documents, approved installation drawings, and requirements of ANSI/SDI RD or ANSI/SDI C as applicable.

E. Ridge and valley plates, flat plates at changes of deck direction and sump pans, if required shall be fastened to the deck in accordance with the Contract Documents, approved installation drawings and requirements of ANSI/SDI RD or ANSI/SDI C as applicable.

F. Reinforce steel deck openings per contract documents and approved shop drawings.

G. Trades that subsequently cut unscheduled openings through the deck are responsible for reinforcing the openings.

H. Acoustical Batt Insulation: Supplied by the deck manufacturer and installed by the roofing contractor prior to installation of roof insulation.

3.4 FIELD QUALITY CONTROL

A. Do not use deck units as a working platform or storage area until units are in position and permanently attached to the structure.

B. Construction loads must not exceed load carrying capacity of the deck.

3.5 INSPECTION AND REPAIR

A. Before roof insulation placement, the deck shall be inspected for tears, dents, or other damage that will affect structural performance.

3.6 PROTECTION

Protect installed products until completion of project.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED STEEL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof joist framing.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-in-Place Concrete Work.
B. Section 05 12 00 – Structural Steel
C. Section 05 12 13 – Architecturally Exposed Structural Steel
D. Section 05 31 23 – Steel Roof Decks
E. Section 05 40 00 – Cold Formed Steel Framing
F. Section 09 90 00 – Painting and Coating
G. Section 09 91 23 – Interior Painting

1.3 REFERENCES

A. American Iron and Steel Institute (AISI).

1. Specification for the Design of Cold-Formed Steel Structural Members.

2. AISI S210 - North American Standard for Cold-Formed Steel Framing - Floor and Roof System Design.

B. American Society for Testing and Materials (ASTM).

1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process..

2. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

3. A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

4. C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases.

5. C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

6. C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

C. International Building Code (IBC).

1.4 SUBMITTALS

A. Submit the following in accordance with Division 1 Section "Submittal Procedures."

B. Product Data: For each type of cold-formed metal framing product and accessory indicated.

C. Welding certificates.

D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Expansion anchors.
2. Powder-actuated anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.
5. Miscellaneous structural clips and accessories.

E. Shop Drawings: Framing layout, components, connections, fastenings, and pertinent details.

F. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code-Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: All structural studs shall be 50 ksi steel.
2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).
3. Minimum sheet steel Thickness: 0.054 inch (1.37 mm).

B. Steel Sheet for Vertical Deflection: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by Structural Drawings.
2. Coating: G90 (Z275).

2.3 ROOF FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths as required, punched with stiffened flanges.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths as required, unpunched, with unstiffened flanges.

C. Premanufactured Connection Hardware: Steel Stud Connectors and Bypass Framing Fixed-Clip Connectors, capable of transferring required loads through positive mechanical attachment to stud web.

1. Subject to compliance with requirements, provide products by one of the following:

a. Simpson Strong-Tie.

b. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A1003, Structural Grade 50, Type H unless noted otherwise.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

C. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.

2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed metal framing members by welding or screw fastening as indicated on Structural Drawings. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed metal framing members by welding or screw fastening. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 INSTALLATION - JOISTS

A. Place joists at spacings indicated on the Drawings.

1. Connect members to supports using fastener method.

B. Set members parallel and level; install lateral bracing and bridging where indicated.

C. Locate joists directly over bearing studs or provide load distribution member.

D. Do not splice joists.

E. Provide web stiffeners at reaction points and points of concentrated loads.

F. Provide end blocking where joist ends are not otherwise restrained from rotation.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. The extent of metal fabrications work is shown on the Drawings and includes items fabricated from iron, steel, stainless steel and aluminum shapes, plates, bars, sheets, strips, tubes, pipes, and castings which are not a part of structural steel or other metal systems in other sections of these specifications.

1. Steel Framing is covered in Section 05 12 00 - Structural Steel Framing.
2. Metal Roof Decking is covered in Section 05 31 23 - Steel Roof Decking.
3. Cold Formed Steel Framing is covered in Section 05 40 00 - Cold Formed Steel

B. Section Includes:

1. Shop-fabricated metal items.
2. Ladders.
3. Anchor bolts.
4. Gratings.
5. Access Hatches.
6. Cable Trench.
7. Fasteners.
8. Galvanized Handrails and railings.
9. Rough Hardware
10. Miscellaneous fabrications, framing, and supports.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-in-Place Concrete Work.
B. Section 05 12 00 – Structural Steel
C. Section 05 12 13 – Architecturally Exposed Structural Steel
D. Section 05 31 12 – Steel Roof Decks
E. Section 05 40 00 – Cold Formed Steel Framing
F. Section 09 90 00 – Painting and Coating
G. Section 09 91 23 – Interior Painting

1.3 REFERENCE STANDARDS

A. Aluminum Association:

1. AA DAF-45 - Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association:

1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. American National Standards Institute:

1. ANSI A14.3 - American National Standard (ASC) for Ladders - Fixed - Safety Requirements.

D. American Welding Society:

1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.
3. AWS D1.6 - Structural Welding Code - Stainless Steel.

E. ASTM International:

1. ASTM A6 - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

2. ASTM A36 - Standard Specification for Carbon Structural Steel.

3. ASTM A47, grade as selected - Malleable Iron Castings.

4. ASTM A48, Class 30 - Gray Iron Castings.

5. ASTM A53- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

6. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

7. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

8. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

9. ASTM A193 - Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High-Pressure Service and Other Special Purpose Applications.

10. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

11. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless-Steel Tubing for General Service.

12. ASTM A283, Grade C - Steel Plates to be Bent or Cold Formed.

13. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.

14. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

15. ASTM A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless-Steel Pipes.
16. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
17. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
18. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
19. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
20. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
21. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
22. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
23. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
24. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
25. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
26. ASTM A992 - Standard Specification for Structural Steel Shapes.
27. ASTM B26 - Standard Specification for Aluminum-Alloy Sand Castings.
28. ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings.
29. ASTM B177 - Standard Guide for Engineering Chromium Electroplating.
30. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
31. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
32. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.
33. ASTM B 308, Alloy 6061-T6, Anodic Coating Class I, AA-C22-A41, anodized after fabrication - Structural Aluminum Shapes and Plates.
34. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

35. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

36. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

37. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

38. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength.

39. ASTM F436 - Standard Specification for Hardened Steel Washers.

40. ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

41. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.

F. Builders Hardware Manufacturers Association (BHMA):

1. ANSI/BHMA A156.20 - American National Standard for Strap and Tee Hinges and Hasps.

G. National Ornamental & Miscellaneous Metals Association:

1. NOMMA Guideline 1 - Joint Finishes.

H. SSPC: The Society for Protective Coatings:

1. SSPC - Steel Structures Painting Manual.
2. SSPC Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
3. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic).
4. SSPC SP 1 - Solvent Cleaning.
5. SSPC SP-7 Brush-off Blast Cleaning.
6. SSPC SP 10 - Near-White Blast Cleaning.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Data: For information only, submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in miscellaneous metal work, including paint products.

C. Shop Drawings:

1. General: Submit copies of shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work which are not completely shown by the manufacturer's data sheets.

a. Include plans, elevations and details of sections and connections and fabricators proposed shop coat paint or galvanizing specifications.

b. Shop drawings shall include size and location of drain holes for galvanizing process. Submit for engineer approval.

c. Show anchorage and accessory items.

d. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete construction.

e. Indicate welding procedures that comply with applicable AWS standards. Welding procedures shall be submitted for review along with manufacturer and make of weld filler material.

f. Indicate welded connections using standard AWS A2.4 welding symbols.

g. Indicate net weld lengths.

2. Stairs, Handrails and Railings:

a. Indicate profiles, sizes, and accessories.

b. Clearly identify connection on Shop Drawings with complete details to the extent that all connections can be made without further reference to the Contract Documents.

c. Include information indicating weld type, joint preparation information such as degree of bevel, weld length, etc. Indicated root openings, back-ups, filler, runout tabs, etc.

d. Indicate changes from the Contract Documents on the Shop Drawings. Structural calculations for any proposed changes or alterations to the configuration shown in the drawings. Calculations shall be Stamped by a Structural Engineer licensed in the State of Oregon.

3. Gratings:

a. Indicate details of gratings, plates, component supports, anchorages, openings, perimeter construction details, and tolerances. All grating connection shall use a bolted or machine-screw attached saddle clip. Self-tapping screws shall not be used in grating connections.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

E. Delegated Design Submittals:

1. Submit signed and sealed Shop Drawings from a registered, licensed professional engineer within the State of Oregon.

2. Include design calculations and assumptions for the following:

a. Incidental Supports

1) Pipe, duct and conduit bracing for all elements not specifically designed in the project drawings.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Qualifications Statement:

1. Submit qualifications for licensed professional to perform Delegated Design Submittals as noted above.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Transporting, handling, storing, and protecting products shall be in accordance with manufacturer's requirements.

B. Inspection: Accept metal fabrications on-site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather or by ground contact.

1.6 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to preparation of Shop Drawings and fabrication. Indicate field measurements on Shop Drawings.

1. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication.

PART 2 PRODUCTS

2.1 GENERAL

A. For the fabrication of miscellaneous metal work items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, roughness and defects which impair strength, durability, and appearance. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating and application of surface finishes including zinc coatings.

2.2 FABRICATED ARCHITECTURAL TRIM

A. Description: Steel sections, size and configuration as indicated on Drawings.
B. Shop Finish for Exterior Locations: Galvanized.

2.3 ANCHOR BOLTS

A. All anchors shall be epoxy anchors or expansion anchors as shown in the Drawings.

B. Materials:

1. As shown in the Drawings.

2. For direct bury:

    a. Malleable iron complying with ASTM A47.
    b. Cast steel complying with ASTM A27.
    c. Iron and steel galvanized in compliance with ASTM A153.

3. For wetted atmospheric conditions

    a. Type 316 stainless steel for bolts and expansion anchors.
    b. Galvanized steel for threaded rods

4. Threaded rod, nuts, bolts, and washers:

    a. Material matching anchor insert type.

C. Types:

1. Threaded-type Concrete Inserts:

    a. Internally threaded to receive machine bolts.
    b. Malleable iron, ASTM A47.
    c. Cast steel, ASTM A27.
    d. Stainless steel, ASTM F593, Group 1-CW1 Type 316.

2. Wedge-type Concrete Inserts:

    a. Box-type ferrous castings designed to accept bolts having special wedge-shaped heads.

3. Slotted-type Concrete Inserts:

    a. Box-type welded construction with slot designed to receive square head bolt and with knockout cover.

4. Screw bolts

    a. Case hardened low carbon steel, mechanically galvanized per ASTM B695, Class 55.

D. Manufacturers:

1. Hilti, Inc.
2. Simpson Strong-Tie Co., Inc.
3. DeWalt, Inc.
4. Proprietary products as named in the Drawings.

2.4 ACCESS HATCHES

A. Use materials of the size and thickness shown in Drawings or, if not shown in the Drawings, of the size recommended by product manufacturer.

B. Work to the dimension shown in the Drawings or accepted on final shop drawings, using proven details of fabrication and support.

C. Use the type of materials shown or specified for the various components of the Work.

D. Vault Access Hatch:

1. Access hatches shall be single or double leaf diamond plate aluminum with dimensions and features as shown on the Drawings. The minimum design load shall be H-20 loading for exterior hatches.

2. Hardware shall be Type 316 stainless steel. This includes nuts, bolts, washers, hinges, springs, spring assisted operators, and automatic hold open arm with release lever.

3. Each leaf shall have a spring-assisted operator to reduce lifting force to 10-30 pounds where shown.

4. Recessed padlock hasp with hinged cover.

5. The leaves shall securely latch when closed.

6. Frames shall be structural aluminum with coating, as specified herein, to protect aluminum from concrete.

7. Flush grip handle.

8. Heavy duty automatic lock open arm with red vinyl release grip.

9. Channel frame with 1-1/4" anchor flange around the perimeter, equipped with a neoprene gasket for weather tight seal and side bottom outlet 1-1/2" aluminum IPS threaded drain coupling outlet integrated into the frame.

10. Stainless steel slam-lock.

11. Shop finish of cover and frame: Mill finish.

12. Safety grate system with 6061-T6 aluminum construction with minimum 300 lb. pedestrian load independent of hatch cover reinforcing.

E. Access hatches shall be manufactured by U.S.F. Fabrication, or approved equal.

2.5 CABLE TRENCH

A. Electrical cable trench tray for power and control cables from the disconnect panel to the wet well shall be pre-engineered, manufactures system that conforms to the design loading requirements of AASHTO H-20 and HS-20. This cable trench tray system shall be set in cast in place concrete.

B. A solid ¼" lockable aluminum diamond plate cover shall be supplied with a stainless steel watertight slamlock.

C. All hardware shall be 316 stainless steel.

D. Cast In Place Concrete Work:

1. Cast in place concrete shall meet the requirements of Specification 03 11 00 Concrete Work and shall meet the dimensional requirements as shown on the drawings.

E. Manufacturer

1. Cable trench tray shall be manufactured by U.S.F. Fabrication, or approved equal.

2.6 HANDRAILS AND GUARDRAILS

A. Railing Shall meet requirements of IBC or OSHA and local codes.

B. Loads:

1. Railing assembly, and attachments to resist concentrated lateral force of 200 pounds at any point in any direction

2. Top rail to resist a uniform load of 50 pounds per linear foot applied horizontally to without damage or permanent set.

3. Mid-rails with corner returns to withstand a 300-pound concentrated vertical load applied at any point or direction without damage and loosening of pipe, fittings, or attachment hardware.

4. Test according to ASTM E935. Load conditions stated do not have to be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movement in the design, fabrication, and installation of handrails to prevent buckling, opening up of joints, over stressing of components, connection, and other detrimental effects. Base design calculation on actual surface temperatures of materials due to both solar heat gain and night time sky heat loss. The temperature change is the difference between high or low temperature and installation temperature.

1. General Steel Railing Construction:

a. Include guardrails, handrails, midrails and toe plates in accordance with OSHA requirements.

1) Guard Height: 3 foot 6-inch high.
2) Handrail Height: Min. 2 foot 6-inch to Max 3 foot 2-inch.

b. Outside diameter:

1) 2-inch for components (based on 1-1/2-inch Schedule 40 pipe).

c. Top corners of handrail are to be bent to the smallest radius possible without causing grain separation or otherwise impairing the work.

d. Radius Sections -- Roll to radii shown on Drawings.

e. Vertical segments of handrail are to be set plumb and mount as shown on Drawings or as otherwise specified.

f. Spacing between vertical segments will be according to Drawings.

2. Welded Connections:

a. Cope intersections of rails and posts, weld joints of tailings or use welding connectors, at fabricator's option.

1) Other methods of welding may be used when acceptable to the Engineer.

b. Weld corners and seams continuously and in accordance with the recommendations of AWS.

c. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.

d. Discoloration of finished surfaces and sharp edges will not be acceptable.

3. Materials: As shown on the Drawings.

2.7 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting systems. Acceptable manufacturers are Simpson or approved equal.

B. Manufacture or fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere furnish galvanized steel washers.

2.8 MISCELLANEOUS FABRICATIONS, FRAMING AND SUPPORTS

A. Provide miscellaneous steel framing and supports required to complete the Work.

B. Fabricate miscellaneous units to the sizes, shapes and profiles shown in the Drawings or, if not shown, of the required dimensions to receive adjacent grating, plates doors, or other work to be retained by the framing.

C. Except as otherwise shown, fabricate from structural steel shapes and plate and steel bars, all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection.

D. Cut, drill, and tap units to receive hardware and similar items to be anchored to the work.

E. Equip units with integrally welded anchors for casting into concrete, bolting to structural steel or building into masonry. Furnish inserts if units must be installed after concrete is placed.

F. Galvanize all miscellaneous fabrications unless otherwise noted.

2.9 NON-SHRINK GROUT

A. Where required for anchoring, patching, or sealing, grouting, and sealing compounds shall conform to the requirements of Section 03 60 00, Grouting.

2.10 MATERIALS

A. Materials listed below shall be provided unless otherwise noted in the Drawings or other sections of these specification.

B. Steel:

1. Structural W Shapes: ASTM A992.
2. Structural Shapes: ASTM A36.
3. Channels and Angles: ASTM A36.
4. Steel Plate: ASTM A36.
    a. Steel Plate to be Bent or Cold Formed: ASTM A283, Grade C.
5. Hollow Structural Sections: ASTM A500, Grade B.
6. Structural Pipe: ASTM A53, Grade B, Schedule 40 unless shown otherwise in Drawings.
7. Bar: ASTM A36 .
    a. Cold-Finished Steel Bar: ASTM A108, grade as selected by fabricator.
8. Sheet Steel: ASTM A653, Grade 33 Structural Quality.
9. Tubing: ASTM A513, Type 5, minimum 50 ksi yield strength.
10. Standard Bolts: ASTM A307; Grade A.
    a. Washers: ASTM F844.
11. High Strength Bolts: ASTM F3125, Grade A325.
    a. Washers: ASTM F436; Type 1.
12. Nuts: ASTM A563; heavy-hex type.
13. Welding Materials: AWS D1.1; type required for materials being welded.

C. Stainless Steel:

1. Bars and Shapes: ASTM A276; Type 316.
2. Tubing: ASTM A269; Type 316.
3. Pipe: ASTM A312, seamless; Type 316.
4. Plate, Sheet, and Strip: ASTM A666; Type 316.
5. Bolts, Nuts, and Washers: ASTM F593, Group 1-CW1, Type 316.
6. Welding Materials: AWS D1.6; type required for materials being welded.

D. Aluminum:

1. Structural Aluminum Shapes and Plates: ASTM B308, Alloy 6061, Temper T66, Anodic Coating Class I, anodized after fabrication.

2. Aluminum-Alloy-Drawn Seamless Tubes: ASTM B210 Alloy 6063, Temper T6.

3. Aluminum-Alloy Bars: ASTM B211 Alloy 6063, Temper T6.

4. Bolts, Nuts, and Washers: Stainless steel or Steel, galvanized.

5. Welding Materials: AWS D1.1; type required for materials being welded.

E. Bolts, Nuts, and Washers for Equipment and Piping:

1. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items.

2. Carbon Steel:

   a. General: Zinc-coated, ASTM A153.

   b. Structural Connections: ASTM A307, Grade A (60 ksi), hot dip galvanized.

   c. Anchor Bolts: ASTM A307, Grade A (60 ksi), hot dip galvanized.

   d. Manufacturer developed screw bolts: Case hardened steel body and current ESR Testing Report.

   e. Pipe and Equipment Flange Bolts: ASTM A193, Grade B-7.

   f. High Strength Bolts: ASTM F3125, Heavy Hex Head.

3. Stainless Steel: Type 316 stainless steel, Class 2; ASTM A193 for bolts; ASTM A194 for nuts.

   a. Where stainless steel bolts are in contact with dissimilar metals, glass epoxy insulating sleeves and washers shall be used to electrically isolate the bolts.

2.11 FABRICATION

A. Workmanship:

1. Use materials of the size and thicknesses shown in the Drawings or, if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use as approved by the Engineer.

2. Work to the dimensions shown in the Drawings or accepted on Shop Drawings, using proven details of fabrication and support.

3. Use the type of materials shown in the Drawings or specified for the various components of work.

4. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

5. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise shown in the Drawings.

6. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.

B. Fit and shop-assemble items in largest practical sections for delivery to Site.

C. Fabricate items with joints tightly fitted and secured.

D. Continuously seal join members by means of continuous welds in accordance with the recommendations of AWS, unless otherwise noted or approved.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small, uniform radius.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

H. Loose Bearing and Leveling Plates:

1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area.

2. Drill plates to receive anchor bolts and for grouting as required.

3. Galvanize after fabrication.

I. Miscellaneous Steel Trim:

1. Provide shapes and sizes for profiles shown in the Drawings.

2. Except as otherwise indicated, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges.

3. Use concealed field splices wherever possible.

4. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.

J. Fabrication Tolerances:

1. Squareness: 1/8-inch maximum difference in diagonal measurements.
2. Maximum Offset between Faces: 1/16-inch.
3. Maximum Misalignment of Adjacent Members: 1/16-inch.

4. Maximum Bow: 1/8-inch in 48 inches.
5. Maximum Deviation from Plane: 1/16-inch in 48 inches.

2.12 FINISHES

A. Steel:

1. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

2. Do not prime surfaces in direct contact with concrete or where field welding is required.

3. Prime-paint items with one coat, except where galvanizing is specified.

4. Coatings as specified per Section 09 90 00, Painting and Coating.

   a. Primer paint selected must be compatible with the required finish coats of paint.

5. Galvanizing for Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123; hot dip galvanize after fabrication.

6. Galvanizing for Fasteners, Connectors, and Anchors:

   a. Hot-Dip Galvanizing: ASTM A153.
   b. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

7. Chrome Plating: ASTM B177, nickel-chromium alloy, satin finish.

8. Sheet Steel: Galvanized.

9. Bolts: Hot dip galvanized.

10. Nuts: Hot dip galvanized.

11. Washers: Hot dip galvanized.

12. Touchup Primer for Galvanized Surfaces: ASTM A780 (A780M), A1. Repair Using Zinc-Based Alloys (Heat and Stick Method).

B. Stainless Steel:

1. Satin-Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.

2. Mirror-Polished Finish: Number 8, mirror polish with preliminary directional polish lines removed.

C. Aluminum:

1. Protection of All Aluminum:

   a. Aluminum surfaces in contact with cementitious, masonry or dissimilar materials, apply the following coating system:

      1) One (1) coat of epoxy primer, 1 to 2 mils dry film (D.F.).

2) Followed by two (2) coats of Bitumastic, 6 to 8 mils D.F.
3) Followed by two (2) coats of tarset material, 6 to 8 mils D.F.

D. Shop Painting

1. Shop painting of metal fabrications shall be allowed only at the sole discretion of the Engineer.

2. Shop paint miscellaneous metal work in accordance with Section 09 90 00, Painting and Coating, with the following exceptions:

   a. Those members or portions of members to be embedded in concrete or masonry.

   b. Surfaces and edges to be field welded.

   c. Galvanized surfaces.

3. Remove scale, rust, and other deleterious materials before the shop coat of paint is applied.

   a. Clean off heavy rust and loose mill scale in accordance with SSPC SP-7, Brush-off Blast Cleaning.

   b. Remove oil, grease and similar contaminates in accordance with SSPC SP-1, Solvent Cleaning.

4. Immediately following surface preparation, brush, or spray on metal primer paint, applied in accordance with the manufacturer's instructions or as specified below.

5. Apply one (1) shop coat of metal primer paint to fabricated metal items, except apply two (2) coats of paint to surfaces which will be inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

E. Touch-up Painting, Pre-painted Items:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting.

2. Apply touch-up coatings by brush or spray to provide a minimum dry film thickness of the original coating thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal and aluminum where Site welding is required.

B. Furnish setting drawings, diagrams, templates, instructions, and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections. Coordinate delivery of such items to the project Site.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, and free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment until permanent bracing and attachments are installed.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

D. Fit exposed connections accurately together to form tight hairline joints.

E. Grind joints smooth and touch-up shop paint coat.

F. Do not weld, cut, or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication and are intended for bolted or screwed field connections.

G. Field-weld components indicated on Drawings and Shop Drawings.

H. Perform field welding according to AWS D1.1 with regards to procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work.

I. Obtain approval of Engineer prior to Site cutting or making adjustments not scheduled.

3.4 TOLERANCES

A. Maximum Variation from Plumb: 1/4-inch per story or for every 12 feet in height, whichever is greater, non-cumulative.

B. Maximum Variation from Level: 1/16-inch in 3 feet and 1/4-inch in 10 feet.

C. Maximum Offset from Alignment: 1/4-inch.

D. Maximum Out-of-Position: 1/4-inch.

3.5 FIELD QUALITY CONTROL

A. Welding: Inspect welds according to AWS D1.1.

B. Replace damaged or improperly functioning hardware.

C. After erection, touch up welds, abrasions, and damaged finishes with prime paint to match shop finishes.

1. For galvanizing repair, repair any damaged areas by heat and stick method as may be required.

D. Touch up factory-applied finishes according to manufacturer-recommended procedures.

3.6 ADJUSTING

A. Adjust operating hardware and lubricate as necessary for smooth operation.

END OF SECTION

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SECTION 06 05 23 - WOOD, PLASTIC, AND COMPOSITE FASTENINGS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for fasteners and adhesives used in the construction of the wood, plastic, and composite elements of the project.

B. Section includes:

1. Rough carpentry hardware.
2. Nails.
3. Bolts and screws.
4. Framing anchors.
5. Joist, rafter, and beam hangers.
6. Adhesives.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

B. Section 06 17 53 - Shop-Fabricated Wood Trusses.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer’s data on all materials.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer’s handling, delivery, storage, and installation requirements.

PART 2 PRODUCTS

2.1 ROUGH CARPENTRY HARDWARE

Rough carpentry hardware used in project work shall conform to the latest provisions of the Oregon State Structural Specialty Code, the International Building Code (IBC), and to any local codes and ordinances.

2.2 NAILS

A. Steel Common Nails: For framing, appropriately sized for the materials being joined.

B. Hot-Dipped Galvanized Nails: Wherever exposed.

C. Stainless Steel Nails: At locations where stainless-steel hardware is specified. Do not mix dissimilar materials without approval of the ENGINEER.

D. Treated Wood: Hot-dipped galvanized or stainless-steel nails are required at all locations where they are in contact with treated wood.

E. The number and size of nails connecting wood members shall be per the Contract Documents but shall not be less than that set forth in Table 2304.10.2 of the IBC for any members.

2.3 BOLTS AND SCREWS

A. Conforming to ASTM A307, Grade A, appropriately sized for the materials being joined.

B. Use galvanized bolts and screws where exposed or in contact with treated wood or embedded into concrete.

2.4 FRAMING ANCHORS & JOIST, RAFTER AND BEAM HANGERS

A. Use galvanized, minimum 18-gauge steel of the size and type required for the materials connected.

B. Post hot-dip galvanize all connection hardware in contact with pressure treated wood, or use stainless steel connectors.

C. Manufacturers:

1. Simpson “Strong-Tie”.
2. Teco “MiTek” with approved ICC Testing Documentation.
3. Approved equal.

2.5 ADHESIVES

Use gun grade adhesive suitable for bonding various metals and non-metallic materials such as wood, plastic, and glass without primer.

PART 3 EXECUTION

3.1 GENERAL

A. Use only skilled workers and the highest standards of the craft.

B. Lay out, cut, fit, and install all rough carpentry items.

C. Anchor sufficiently to ensure rigidity and permanence as noted on the Drawings.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the work necessary to furnish materials, labor, equipment, and services necessary to provide rough framing as shown on the Drawings and as specified herein.

B. Section includes:

1. Lumber.
2. Plywood.
3. Building paper.

1.2 RELATED SECTIONS

A. Section 06 05 23 - Wood, Plastic, and Composite Fastenings.
B. Section 06 17 53 - Shop-Fabricated Wood Trusses.

1.3 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Procedures.

B. Submit a complete list of products, product information, type, and grade for prior to beginning building construction.

1.4 QUALITY ASSURANCE

A. All work specified herein shall conform to the latest provisions of the International Building Code (IBC), and the local Codes and Ordinances of all Governmental agencies having jurisdiction over the Project.

B. Where special inspection of wood structural elements is required in the Contract Documents, an independent testing agency or laboratory shall perform special inspection of the elements indicated in the Contract Documents. The OWNER or an agent of the OWNER will engage a testing laboratory acceptable to the ENGINEER to perform the required Special Inspections and/or Material Tests.

C. Materials and installed work may require testing and retesting, as directed by the ENGINEER, at any time during the progress of the work.

1. Allow free access to material stockpiles and facilities at all times.

2. All testing required by the contract documents shall be done at the OWNER'S expense.

3. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

1.5 DELIVERY, HANDLING AND STORAGE

A. Immediately upon delivery to Site, place materials in an area protected from weather.

B. Store materials a minimum of six (6) inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Do not store seasoned materials in wet or damp portions of building.

D. Protect sheet materials from breaking corners and damaging surfaces while unloading.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber grading rules and wood species shall be in conformance with the latest edition of U.S. Department of Commerce, National Institute of Standards and Technology, Product Standard DOC PS 20 and the National Forest Products Association.

B. Wood members shall conform to the requirements above and provide design values equal to those published in the "Design Values for Wood Construction," a supplement to the 2018 edition of the National Design Specification for Wood Construction, published by the National Forests Products Association.

C. Plywood grading rules shall be in conformance with the latest edition of U.S. Product Standards PS 1 and PS 2, and be Engineered Wood Association (APA) rated Exposure 1.

2.2 GRADE MARKS

A. Each piece of lumber shall be stamped or branded with the grade as determined by an approved grading association indicating conformance with the latest edition of U.S. Product Standard DOC PS 20.

B. Each panel of plywood shall be identified with the appropriate grade trademark of the American Plywood Association.

C. Moisture content shall not exceed 19 percent, unless otherwise specified.

2.3 LUMBER

A. Dimensions given are nominal. Surface four sides (S4S), unless specified otherwise.

B. Unless otherwise noted, lumber shall be as follows:

Use	Minimum Grade
General framing, studs, plates, blocking, furring, braces and nailers	Douglas Fir-Larch No. 2
Structural light framing, two (2) inches to four (4) inches thick, two (2) inches to six (6) inches wide	Douglas Fir-Larch No. 2
Structural joists, rafters, and planks, two (2) inches to four (4) inches thick, five (5) inches and wider and headers	Douglas Fir-Larch No. 2
Beams, stringers, posts, timber	Douglas Fir-Larch No. 1
Fascia Board	Fiber cement board manufactured by

	James Hardie or approved equal
Sills and Plates	Douglas Fir-Larch No. 2, Treated in accordance with IBC 2303.1.9

2.4 PLYWOOD

A. Roof Sheathing:

1. Conform to APA-rated sheathing and shall be identified with the appropriate trademark.

2. Minimum sheathing shall be Exposure 1, 1/2-inch or greater, grade CDX. Span rated 32/16 per APA.

B. MDO -- APA rated Medium Density Overlay exterior glue.

2.5 BUILDING PAPER

A. Asphalt-saturated felt conforming to ASTM D 226 or D 250, Type I, plain non-perforated.

PART 3 EXECUTION

3.1 GENERAL

A. Use only skilled workers and the highest standards of the craft.

B. Plan work in advance and perform in proper sequence to facilitate prompt and continuous progress of the work.

C. Lay out, cut, fit, and install all rough carpentry items.

D. Anchor sufficiently to ensure rigidity and permanence and as noted on Drawings.

E. Provide for installation and support of other work.

3.2 CONDITIONS OF SURFACES

A. Verify that surfaces to receive rough carpentry materials are prepared to exact grades and dimensions.

3.3 INSTALLATION

A. Plates

1. Set level and flush with outside face of concrete or masonry unit walls or as shown on the Drawings.

2. Anchor into concrete or masonry unit walls with specified anchors.

3. Location and spacing of plate anchorages shall be as shown or if not shown in conformance with current local building codes.

B. Stud Framing

1. Plates and Stud Members

a. Unless shown otherwise in the Drawings, provide pressure treated double top plates, 1-1/2 inches thick by 5-1/2 inches wide (2 x 6). Provide double top plates for the tops of the wood framed interior partition wall, 1-1/2 inches thick by 5-1/2 inches wide (2 x 6). Splice top plates at corners and intersections with an appropriate framing anchor as specified in Section 06 05 23. Stagger top plate laps by a minimum of 4 feet.

b. Provide pressure treated sill plates, 1-1/2 inches thick by 5-1/2 inches wide (2 x 6) for the tops of all concrete or masonry unit stem walls or concrete slabs. Anchor sill plates as specified in Section 06 05 23.

c. Provide studs in continuous lengths without splice.

d. End nail studs to bottom plate and end nail to lower top plate where required.

e. Facenail upper top plate to lower top plate.

f. Anchor plates to concrete or CMU walls as shown on Drawings.

2. Blocking

a. Install continuous, staggered horizontal row where shown on Drawings or required by code.

b. Locate blocking to facilitate installation of finishing materials, fixtures, specialty items, hardware, and trim.

C. Engineered Trusses: See Drawings for requirements and Section 06 17 53, Shop-Fabricated Wood Trusses.

D. Roof Sheathing

1. Install plywood with face grain perpendicular to supports, using panel with continuous end joints over two or more spans staggered between panels and locate over supports.

2. Allow minimum space 1/16-inch (1.6 mm) between end joints and 1/8-inch at edge joints for expansion and contraction of panels.

3. Support edge joints by use of ply clips or lumber blocking, unless noted otherwise on Drawings.

E. Ceiling Plywood

1. Install ceiling plywood where shown on Drawings with joints transverse to the members they attach to.

2. Attach plywood sheets to wood framing using finish nails.

3. Countersink nails.

4. Spackle and sand joints, knot holes, and nail holes as required to provide a smooth uniform surface prior to application of paint coating system as specified in Section 09 90 00, Painting and Coating.

F. Fastener Requirements:

1. Connections for wood members shall be in accordance with the Contract Drawings and Section 06 05 23, Wood, Plastic, and Composite Fastenings.

2. The number and size of nails connecting wood members shall not be less than that set forth in Table 2304.10.2 of the IBC.

END OF SECTION

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SECTION 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for design, manufacture, and supply of wood trusses as shown on the Drawings and as specified.

B. Section includes:

1. Design and performance criteria.
2. Lumber.
3. Metal connecting hardware.
4. Manufacturing requirements.

1.2 RELATED SECTIONS

A. Section 06 05 23 - Wood, Plastic, and Composite Fasteners.
B. Section 06 10 00 - Rough Carpentry.

1.3 DEFINITIONS

A. BCSI*:* Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses jointly produced by the Structural Building Components Association and the Truss Plate Institute.

B. Contractor: The person who contracts with the OWNER, who constructs the Building in accordance with the Construction Documents and the Truss Submittal Package. The term "CONTRACTOR" shall include those subcontractors who have a direct contract with the CONTRACTOR to construct all or a portion of the construction.

C. Cover/Truss Index Sheet: Sheet that is signed and sealed by an Oregon licensed Professional Engineer, by the Truss Design Engineer, and shall contain the following information: (1) identification of the Building, including Building name and address, lot, block, subdivision, and city or county; (2) identification of Construction Documents by drawing number(s) with revision date; (3) specified Building Code; (4) computer program used; (5) roof dead and live loads; (6) floor dead and live loads; (7) wind load criteria from a specifically defined code (e.g., *ASCE 7*) and any other design loads (such as ponding, mechanical loads, etc.); ; (8) a listing of the individual identification numbers and dates of each Truss Design Drawing referenced by the Cover/Truss Index Sheet; and (9) name, address, date of drawing and license number of Truss Design Engineer.

D. Framing Structural System: Completed combination of Structural Elements, Trusses, connections, and other systems, which serve to support the Building's self-weight and the specified loads.

E. Truss: Individual metal-plate-connected wood component manufactured for the construction of a Building.

F. Truss Design Drawing: Written, graphic and pictorial depiction of an individual Truss that includes the information required in the Standard.

G. Truss Design Engineer: Person who is licensed to practice engineering as defined by the Legal Requirements of the Jurisdiction in which the Building is to be constructed and who supervises the preparation of the Truss Design Drawings.

H. Truss Designer: Person responsible for the preparation of the Truss Design Drawings.

I. Truss Manufacturer: Person engaged in the fabrication of Trusses.

J. Truss Placement Diagram: Illustration identifying the assumed location of each Truss.

K. Truss Submittal Package: Package consisting of each individual Truss Design Drawing, and, as applicable, the Truss Placement Diagram, the Cover/Truss Index Sheet, Lateral Restraint and Diagonal Bracing details designed in accordance with generally accepted engineering practice, applicable *BCSI* defined lateral restraint and diagonal bracing details, and any other structural details germane to the Trusses.

1.4 DESIGN

A. Trusses shall be designed in accordance with the Standard and, where any applicable design feature is not specifically covered herein, design shall be in accordance with the applicable provisions of the latest edition of the American Forest & Paper Association's (AF&PA's) *National Design Specification® (NDS®) for Wood Construction* and all applicable Legal Requirements.

B. Truss Manufacturer shall furnish Truss Design Drawings and Calculations prepared in accordance with all applicable Legal Requirements and signed and stamped by an Oregon licensed Professional Engineer.

C. The Truss Manufacturer shall furnish a Truss Placement Diagram, which shall provide, at a minimum, the location assumed for each Truss based on the Truss Manufacturer's interpretation of the Construction Documents.

D. The Truss Manufacturer shall submit the Truss Submittal Package to the OWNER and ENGINEER for review and approval prior to the manufacturing of the Trusses.

E. The Truss Design Drawings shall include, at a minimum, the information specified below (per the Standard):

1. Building Code used for Design, unless specified on Cover/Truss Index Sheet.

2. Slope or depth, span and spacing.

3. Location of all joints and support locations.

4. Number of plies if greater than one.

5. Required bearing widths.

6. Design loads as applicable, including:

    a. Top Chord live load (for roof Trusses, this shall be the controlling case of live load or snow load);

    b. Top chord dead load;

    c. Bottom chord live load;

    d. Bottom chord dead load;

    e. Additional loads and locations;

    f. Environmental Load Design Criteria (wind speed, snow, seismic, and all applicable factors as required to calculate the Truss loads); and

    g. Other lateral loads, including drag strut loads.

7. Adjustments to Wood Member and Metal Connector Plate design values for conditions of use.

8. Maximum reaction force and direction, including maximum uplift reaction forces where applicable.

9. Metal Connector Plate type, manufacturer, size, and thickness or gauge, and the dimensioned location of each Metal Connector Plate except where symmetrically located relative to the joint interface.

10. Size, species, and grade for each Wood Member.

11. Truss-to-Truss connection and Truss field assembly requirements.

12. Calculated span to deflection ratio and/or maximum vertical and horizontal deflection for live and total load and K_{CR} (creep factor) as applicable.

13. Maximum axial tension and compression forces in the Truss members.

14. Fabrication tolerance per the Standard.

15. Required Permanent Individual Truss Member Restraint location and the method of Restraint/Bracing to be used per the Standard.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber:

1. identified by grade mark of a lumber inspection bureau or agency approved by the American Lumber Standards Committee.

2. Of the size, species, and grade as shown on the Truss Design Drawings, or equivalent as approved by the Truss Design Engineer/ Truss Designer.

3. In accordance with Article 2.3, Lumber of Section 06 10 00, Rough Carpentry.

4. Adjustment of value for duration of load or conditions of use shall be in accordance with the latest edition of the National Design Specification for Wood Construction (*NDS)*.

5. Fire retardant treated lumber, if applicable, shall meet the specifications of the fire retardant chemical manufacturer, the Truss design and the Standard and shall be re-dried after treatment in accordance with the American Wood-Preservers' Association (AWPA) Standard *C20 Structural Lumber – Fire Retardant Treatment by Pressure Processes*. Allowable values must be adjusted in accordance with *NDS*. Lumber treater shall supply certificate of compliance.

B. Metal Connector Plates:

1. Manufactured by a Truss Plate Institute (TPI) member plate manufacturer.

2. Shall not be less than 0.036 in. thick (20 gauge).

3. Meet or exceed *ASTM A653/A653M* grade 33.

4. Galvanized coating, meeting, or exceeding *ASTM A924/924M*, coating designation G60. Working stresses in steel are to be applied to effectiveness ratios for plates as determined by test and in accordance with the Standard.

5. In highly corrosive environments, special applied coatings or stainless steel may be required as noted on the Contract Documents.

6. At the request of the ENGINEER, a TPI member plate manufacturer shall furnish a certified record that materials comply with steel specifications.

2.2 MANUFACTURING

Trusses shall be manufactured to meet the quality requirements of the Standard and in accordance with the information provided in the final approved Truss Design Drawings.

PART 3 EXECUTION

3.1 HANDLING, INSTALLING, RESTRAINING AND BRACING

A. Trusses shall be handled during manufacturing, delivery and by the CONTRACTOR at the job site so as not to be subjected to excessive bending.

B. Trusses shall be unloaded in a manner so as to minimize lateral strain. Trusses shall be protected from damage that might result from on-site activities and environmental conditions. Trusses shall be handled in such a way so as to prevent toppling when banding is removed.

C. CONTRACTOR shall be responsible for the handling, installation, and temporary restraint/ bracing of the Trusses in a good workmanlike manner and in accordance with the recommendations set forth in the latest edition of *BCSI*.

D. Apparent damage to Trusses, if any, shall be reported to Truss Manufacturer prior to erection.

E. Trusses shall be set and secured level and plumb, and in correct location. Each Truss shall be held in correct alignment until specified permanent restraint and bracing is installed.

F. Cutting and altering of Trusses is not permitted. If any Truss should become broken, damaged, or altered, written concurrence and approval by a Registered Design Professional is required.

G. Concentrated loads shall not be placed on top of Trusses until all specified restraint and bracing has been installed and decking is permanently nailed in place. Specifically avoid stacking full bundles of plywood or other concentrated loads on top of Trusses.

H. Truss Submittals and any supplementary information provided by the Truss Manufacturer shall be provided by the CONTRACTOR to the individual or organization responsible for the installation of the Trusses.

I. Trusses shall be permanently restrained and braced in a manner consistent with good building practices as outlined in *BCSI* and in accordance with the requirements of the Construction Documents. Trusses shall furthermore be anchored or restrained to prevent out-of-plane movement so as to keep all Truss members from simultaneously buckling together in the same direction. Such permanent lateral restraint shall be accomplished by: (a) anchorage to solid end walls; (b) permanent diagonal bracing in the plane of the web members; or (c) other suitable means.

J. Materials used in temporary and permanent restraint and bracing shall be furnished by CONTRACTOR.

END OF SECTION

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SECTION 06 61 00 - FIBERGLASS REINFORCED PLASTICS (FRP) FABRICATIONS, MOLDED GRATING

PART 1 GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall furnish, modify (where necessary), and install all fiberglass reinforced plastic (FRP) items, along with all support structures, appurtenances, accessories, and incidentals necessary to produce a complete, fully supported, operable and serviceable installation as shown on the Contract Drawings and as specified herein, and in accordance with the requirements of the Contract Documents.

1.2 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications

1.3 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Procedures.

B. The CONTRACTOR shall furnish shop drawings of all fabricated gratings and accessories in accordance with the provisions of this Section. Shop drawings shall include information on the FRP grating support structure as well as details for intermediate support structure necessary for supporting FRP grates at cuts and penetrations.

C. The CONTRACTOR shall furnish manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.

1. The FRP grating sections shall be designed so as to be removeable. Individual FRP panels sections shall not weigh more than 100-lbs.

D. The CONTRACTOR shall submit the manufacturer’s published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.

E. The CONTRACTOR may be requested to submit sample pieces of each item specified herein for acceptance by the ENGINEER as to quality and color. Sample pieces shall be manufactured by the method to be used in the Work.

1.4 REFERENCES

A. The publications listed below (latest revision applicable) form a part of this specification to the extent referenced herein. The publications are referred to within the text by the designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) Test Methods:

1. ASTM D635 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

2. ASTM D732 Shear Strength of Plastics by Punch Tool

3. ASTM E84 Surface Burning Characteristics of Building Materials

1.5 QUALITY ASSURANCE

A. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years' experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

B. Manufacturer shall offer a 3-year limited warranty on all FRP products against defects in materials and workmanship.

C. Manufacturer shall be certified to the ISO 9001: 2015 standard.

D. Manufacturer shall provide proof of certification from at least two other quality assurance programs for its facilities or products (DNV, ABS, USCG, AARR).

E. Manufacturer shall provide proof, via independent testing less than six months old, that materials proposed as a solution do not contain heavy metals in amounts greater than that allowed by current EPA requirements.

1.6 DELIVERY, HANDLING AND STORAGE

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

B. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Adhesives, resins, and their catalysts are to be stored in dry indoor storage facilities between 70- and 85-degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Pultruded gratings shall be Safe-T-Span® or DURAGRID® (or ENGINEER approved equal) as manufactured by

Fibergrate Composite Structures Inc. (Safe-T-Span)
5151 Belt Line Road, Suite 1212
Dallas, Texas 75254-7028 USA
Phone: (800) 527 4043

(972) 250 1530 Fax

Website: www.fibergrate.com
E-mail: info@fibergrate.com

STRONGWELL Corporation (Duragrid)
400 Commonwealth Ave.
Bristol, Virginia 24201-3820 USA
Phone (276) 645-8000
Fax (276) 645-8132

Website: www.strongwell.com
E-mail: gsmith@strongwell.com

2.2 GENERAL

A. All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements, and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

B. Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.

C. Resin shall be Vinyl Ester or Isophthalic Polyester with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

D. All finished surfaces of FRP items and fabrications shall be smooth, resin rich, free of voids and without dry spots, cracks, crazes, or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

E. All pultruded structural shapes shall be further protected from ultraviolet (UV) light with 1) integral UV inhibitors in the resin and 2) a synthetic surfacing veil to help produce a resin rich surface.

F. All fire-retardant molded grating products shall have a tested flame spread rating of 25 or less per ASTM E84 Tunnel Test. Gratings shall not burn past the 1 inch (25 mm) reference mark and will be classified HB per ASTM D635.

G. All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

2.3 MOLDED FRP GRATING

A. Manufacture: Grating components shall be high strength and high stiffness pultruded elements having a maximum of 70% and a minimum of 60% glass content (by weight) of continuous roving and continuous strand mat fiberglass reinforcements. The finished surface of the product shall be provided with a surfacing veil to provide a resin rich surface which improves corrosion resistance and resistance to ultraviolet degradation. Bearing bars shall be interlocked and epoxied in place with a two-piece cross rod system to provide a mechanical and chemical lock. Cross rods should be below the walking surface of the grating. Gratings with cross rods that are flush with the walking surface are excluded.

B. Non-slip surfacing: Grating shall be provided with a quartz grit bonded and baked to the top surface of the finished grating product.

C. Grating bar intersections are to be filleted to a minimum radius of 1/16” to eliminate local stress concentrations and the possibility of resin cracking at these locations.

D. Fire rating: Grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E84. Manufacturer may be required to provide certification of ASTM E84 test on grating panels from an independent testing laboratory. Test data shall be from full scale testing of actual production grating, of the same type and material supplied on the project. Test data performed only on the base resin shall not be acceptable.

E. Resin system: The resin system used in the manufacture of the grating shall be VEFR or ISOFR. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating corrosion resistance and shall not be accepted.

F. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating product corrosion resistance and shall not be accepted.

G. Color: Gray, Yellow, or as allowed by OWNER

H. Depth: 2" deep load bars with a tolerance of plus or minus 1/32".

I. Mesh Configuration: 2" load bar spacing, 6" tie bar spacing on centers. Grating shall be SAFE-T-SPAN® T5020V or T5020I as manufactured by Fibergrate Composite Structures Incorporated.

J. Load/Deflection: Grating design loads shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Grating shall be designed for a uniform load of 125 psf or concentrated load of 300 lb. Live load deflection is not to exceed 0.25” or L/D = 360, whichever is less.

K. The manufacturer shall certify that the stiffness of all panels manufactured are never more than 2.5% below the published load-deflection values.

L. Substitutions: Other products of equal strength, stiffness, corrosion resistance and overall quality may be submitted with the proper supporting data to the ENGINEER for approval.

2.4 GRATING FABRICATION

A. Measurements: Grating supplied shall meet the minimum dimensional requirements as shown or specified. The CONTRACTOR shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work. Determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.

B. Layout: Each grating section shall be readily removable, except where indicated on drawings. Manufacturer to provide openings and holes where located on the contract drawings. Grating

supports shall be provided at openings in the grating by CONTRACTOR where necessary to meet load/deflection requirements specified herein. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.

C. Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the CONTRACTOR in accordance with the manufacturer's instructions.

D. Hardware: Type 316 stainless steel hold down clips shall be provided and spaced at maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

PART 3 EXECUTION

3.1 INSPECTION

A. Shop inspection is authorized as required by the OWNER and shall be at OWNER's expense. The fabricator shall give ample notice to CONTRACTOR prior to the beginning of any fabrication work so that inspection may be provided. The grating shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits. The surface shall have a smooth finish (except for grit top surfaces).

3.2 INSTALLATION

A. CONTRACTOR shall install gratings in accordance with manufacturer’s assembly drawings. Fasten grating panels securely in place with hold down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Ensure all cuts are adequately supported. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

END OF SECTION

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Board insulation perimeter foundation wall and over roof sheathing.

B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Installation requirements for board insulation over steep slope roof sheathing or roof structure.

1.3 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2022.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2023.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023b.

D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.5 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

B. Insulation in Wood Framed Ceiling Structure: Batt insulation with integral vapor retarder.

C. Insulation Over Roof Deck: Extruded polystyrene (XPS) board.

2.2 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.

1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.

2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.

5. Board Edges: Square.

6. Type and Water Absorption: Type XII, 0.3 percent by volume, maximum, by total immersion.

7. Minimum Individual Board Thickness: 1-1/2 inch (38 mm)

8. Total Insulation Thickness: As required to meet minimum energy code thermal envelop requirement listed on drawings.

9. Products:

a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com/#sle.

b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi: www.kingspan.com/#sle.

c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation : www.ocbuildingspec.com/#sle.

d. Or approved Equal.

e. Substitutions: See Section 01 60 00 - Product Requirements.

2.3 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.

1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.

2. Facing: Asphalt treated Kraft paper, one side.

3. Products:

a. CertainTeed Corporation: www.certainteed.com/#sle.

b. Johns Manville: www.jm.com/#sle.

c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

A. Installation of board insulation over steep slope roof structure or roof sheathing, see Section 06 10 00.

B. Install per manufacturers recommendations.

3.4 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.5 FIELD QUALITY CONTROL

A. See Section 01 45 00 – Quality Control

3.6 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

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SECTION 07 25 00 - WEATHER BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water-resistive barriers.

1.2 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023b.

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).

D. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.

E. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers 2016, with Editorial Revision (2021).

PART 2 PRODUCTS

2.1 WATER-RESISTIVE BARRIER MATERIALS

A. Water-Resistive and Air Barrier, Multilayers: Outer layers of nonwoven, spunbonded polypropylene with vapor permeable, watertight polymeric middle layer.

1. Air Permeance: 0.0011 cfm/sq ft (0.0058 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 54 perms (3,078 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F (23 degrees C).

3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 3 months of weather exposure.

4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.

5. Seam and Perimeter Tape: As recommended by sheet manufacturer.

B. Water-Resistive Barrier, Composite: Tear-resistant polyester sheet with UV-resistant acrylic coating.

1. Air Permeance: 0.18 cfm/sq ft (0.9 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 200 perms (11,400 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F (23 degrees C).

3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 210 days of weather exposure.

4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.

5. Water Resistance: Comply with applicable requirements in accordance with ICC-ES AC38.

6. Seam and Perimeter Tape: As recommended by sheet manufacturer.

2.2 ACCESSORIES

A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.

1. Width: 4 inches (102 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Water-Resistive Barriers: Install continuous water-resistive barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

C. Mechanically Fastened Exterior Sheets:

1. Install sheets shingle-fashion to shed water, with seams aligned horizontal.

2. Overlap seams as recommended by manufacturer, 6 inches (152 mm), minimum.

3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches (305 mm), minimum.

4. Install water-resistive barrier over jamb flashings.

5. Install head flashings under water-resistive barrier.

6. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.

D. Openings and Penetrations in Exterior Water-Resistive Barriers:

1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches (127 mm) onto water-resistive barrier and at least 6 inches (152 mm) up jambs; mechanically fasten stretched edges.

2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.

3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.

4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches (50 mm) beyond face of jambs; seal water-resistive barrier to flashing.

5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.

6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

END OF SECTION

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SECTION 07 30 12 - ROOFING UNDERLAYMENT, EXTENDED HIGH-TEMPERATURE

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies a self-adhering sheet membrane used as underlayment for sloped roofs.

1. High temperature application, 300F resistance, extended period, Ultratm, or approved equal.

B. Related Sections: Refer to the following specification sections for coordination:

1. Section 06 10 00 – Rough Carpentry.
2. Section 07 41 13 – Metal Roof Panels.
3. Section 07 62 00 – Sheet Metal Flashing and Trim
4. Section 07 92 00 – Joint Sealants

C. Referenced Standards: Comply with the requirements of the following standards published by ASTM International to the extent referenced in this section.

1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

2. ASTM D461 - Standard Test Methods for Felt.

3. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

4. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

5. ASTM D3767 - Standard Practice for Rubber—Measurement of Dimensions.

6. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

7. ASTM G90 – EMMAqua test.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable codes at the location of the project.

B. Manufacturer: Minimum 10 years experience producing roofing underlayment.

C. Installer: Minimum 2 years experience with installation of similar underlayment.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened factory labeled packages. Protect from damage.

B. Cover materials and store in dry condition between temperatures of 40 and 90 degrees F (5 and 32 degrees C). Use within one year of date of manufacture. Do not store at elevated temperatures as that will reduce the shelf life of the product.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: GCP Applied Technologies, Inc, 62 Whittemore Avenue, Cambridge, MA 02140, Toll Free 866-333-3726, www.gcpat.com.

B. Or approved Equal

C. Substitutions: See 01 60 00 Product Requirements.

2.2 MATERIALS

A. Basis of Design: Self-Adhering Sheet Membrane Roof Underlayment: Provide Ultra by GCP Applied Technologies, Inc with the following characteristics:

1. Cold applied, self-adhering membrane composed of a high strength polyethylene film coated on one side with a layer of butyl rubber adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the polyethylene.
2. Color: Gray-black.
3. Membrane Thickness: 30 mil (0.76 mm) ASTM D3767 method A.
4. Tensile strength, Membrane: 250 psi (1720 kN/m2) ASTM D412 (Die C modified).
5. Elongation, Membrane: 250% ASTM D412 (Die C modified).
6. Low Temperature Flexibility: Unaffected @ -20°F (-29°C) ASTM D1970.
7. Adhesion to Plywood: 3.0 lbs/in width (525 N/m) ASTM D903.
8. Permeance (max): 0.05 Perms (2.9 ng/m2s Pa) ASTM E96.
9. Material Weight Installed (max): 0.22 lb/ft2 (1.1 kg/m2) ASTM D461.
10. Service Temperature: 300 degrees F (148.8 degrees C) per ASTM D1204
11. Primer: Water-based Perm-A-Barrier WB Primer by GCP Applied Technologies, Inc.
12. Code and Standards Compliance: Ultra meets the following requirements:
    a. ICC ESR-1677 approval according to AC-48 Acceptance Criteria for Self-Adhered underlayments used as Ice Barriers
    b. Underwriters Laboratories, Inc. R13399 Class A fire classification under fiberglass shingles and Class C under organic felt shingles.

c. Underwriters Laboratories, Inc. Classified Sheathing Material Fire Resistance Classification Design Numbers P225, P227, P230, P237, P259, P508, P510, P512, P514, P701, P711, P717, P722, P723, P732, P734, P742, P824.

B. Or Approved Equal

C. Subtitutions: See Section 01 60 00 Product Requirements

PART 3 EXAMINATION

3.1 INSTALLATION

A. Prior to start of installation, inspect existing conditions to ensure surfaces are suitable for installation of roofing underlayment. Verify flashing has been installed. Starting work indicates installers acceptance of existing conditions.

B. Install roofing underlayment on sloped surfaces at locations indicated on the Drawings, but not less than at hips, ridges, eaves, valleys, sidewalls and chimneys, and surfaces over interior space within 36 inches (914 mm) from the inside face of the exterior wall. Strictly comply with manufacturer's installation instructions including but not limited to the following:

1. Schedule installation such that underlayment is covered by roofing within the published exposure limit of the underlayment.

2. Do not install underlayment on wet or frozen substrates.

3. Install when surface temperature of substrate is a minimum of 40 degrees F (5 degrees C) and rising.

4. Remove dust, dirt, loose materials and protrusions from deck surface.

5. Install membrane on clean, dry, continuous structural deck. Fill voids and damaged or unsupported areas prior to installation.

6. Prime concrete and masonry surfaces using specified primer at a rate of 500-600 square feet per gallon (12-15 sqm/L). Priming is not required for other suitable clean and dry surfaces.

7. Install membrane such that all laps shed water. Work from the low point to the high point of the roof at all times. Apply the membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application of the membrane up the roof. Membrane may be installed either vertically or horizontally after the first horizontal course.

8. Side laps minimum 3-1/2 inches (89 mm) and end laps minimum 6 inches (152 mm) following lap lines marked on underlayment.

9. Patch penetrations and damage using manufacturer's recommended methods.

3.2 CLEANING AND PROTECTION

A. Protect from damage during construction operations and installation of roofing materials. Promptly repair any damaged or deteriorated surfaces.

B. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired in the opinion of the Architect.

C. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protective film and reclean as necessary immediately before final acceptance.

END OF SECTION

SECTION 07 41 13 - METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal roof panel system of preformed steel panels.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Roof sheathing.

B. Section 07 21 00 - Thermal Insulation: Rigid roof insulation.

C. Section 07 92 00 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.3 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

B. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference 2005 (Reapproved 2017).

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Storage and handling requirements and recommendations.

2. Installation methods.

3. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.

1. Show work to be field-fabricated or field-assembled.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches (305 mm) square, representing actual roofing metal, thickness, profile, color, and texture.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

1.7 FIELD CONDITIONS

A. Do not install metal roof panels, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F (7 degrees C).

1.8 WARRANTY

A. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

B. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Architectural Metal Roof Panel Manufacturers:

1. Taylor Metal Products; Easy-Lock Standing Seam: www.taylormetal.com

a. Basis of Design: Taylor Metal Products; Easy-Lock Standing Seam

1) Coverage: 12"

2) Gauge: 24

3) Profile: 1 1/8" vertical rib with 3/8" flat top. with 3 accent ribs

4) Fasteners: Concealed with pre-slotted fastener flange to allow expansion/contraction of panel.

5) Color: To be selected by Architect from Manufacturer's standard colors.

2. Or approved Equal

3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Metal Soffit Panels Manufacturers:

1. Taylor Metal Products; Lifetime Sofffit: www.talormetal.com

a. Basis of Design: Taylor Metal Products; Lifetime Soffit

1) Coverage: 12"

2) Gauge: 24

3) Profile: 1" with double bead - non-perforated

4) Fasteners: Concealed with pre-slotted fastener flange to allow expansion/contraction of panel.

5) Color: To be selected by Architect from Manufacturer's standard colors.

2. Or approved Equal

3. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:

1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.

2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.

3. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).

2.3 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.4 FABRICATION

A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.5 FINISHES

A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat metal coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss to match sample.

2.6 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:

1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.

B. Coordinate installation of waterproof membrane over roof sheathing with Section 06 10 00.

C. Remove protective film from surface of roof panels immediately prior to installation; strip film carefully to avoid damage to prefinished surfaces.

D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

E. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

F. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.

1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.

2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.

B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.

3.4 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.5 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

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SECTION 07 42 13 - METAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, with related flashings and accessory components.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wall panel substrate.

B. Section 07 21 00 - Thermal Insulation.

C. Section 07 25 00 - Weather Barriers: Weather barrier under wall panels.

D. Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.3 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.

1.4 SUBMITTALS

A. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.

B. Samples: Submit two samples of each type of wall panel and soffit panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

C. Manufacturer's qualification statement.

D. Installer's qualification statement.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.7 WARRANTY

A. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

B. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of metal wall panels. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 METAL WALL PANEL SYSTEM

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.

1. Provide exterior wall panels.

2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.

3. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.

4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.

5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.

7. Corners: Factory-fabricated in one continuous piece with minimum 2-inch (51 mm) returns.

8. Provide continuity of air barrier seal at building enclosure elements in accordance with requirements; see Section 07 27 00.

B. Exterior Wall Panels:

1. Basis of Design Type: MP-1:

a. Slim-lock Standing Seam manufactured by Taylor Meal Products.
b. Or Approved Equal.
c. Substitutions: See 7.02 General Conditions for Product Substitution.
d. Profile: Vertical; style as indicated.

e. Side Seams: sealed per manufacturer's written instructions..
f. Color: As selected by Architect from manufacturer's standard line.

C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

D. Expansion Joints: Same material, thickness and finish as exterior sheets; manufacturer's standard brake formed type, of profile to suit system.

E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

F. Anchors: Per manufacturer's written instructions..

2.2 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.3 FINISHES

A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.

B. Panel Backside Finish: Panel manufacturer's standard siliconized polyester wash coat.

2.4 ACCESSORIES

A. Cladding Support Clips: Manufactuer's standard panel support clip.

1. Galvanized Steel Support Clip: G90/Z275 galvanized coating complying with ASTM A653/A653M support clip with integral glass fiber reinforced polyamide thermal isolator pad.

B. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

C. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 07 92 00

D. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

E. Fasteners: Manufacturer's standard type to suit application; .

F. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify weather barrier has been installed over wall panel substrate, see Section 07 25 00.

3.2 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at intervals indicated.

3.3 INSTALLATION

A. Install panels on walls in accordance with manufacturer's instructions.

B. Use concealed fasteners unless otherwise indicated by Architect.

3.4 TOLERANCES

A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch (1.6 mm), maximum.

B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch (6.4 mm), maximum.

3.5 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

D. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

A. Section 07 41 13 - Metal Roof Panels

B. Section 07 42 13 - Metal Wall Panels

1.3 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.

F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).

I. CDA A4050 - Copper in Architecture - Handbook current edition.

J. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.4 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples, 4 by 6 inches (102 by 152 mm) in size, illustrating metal finish color.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.

1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.

2. Color: To match adjacen pre-finished metal materials.

B. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch (1.02 mm) thick; plain finish shop pre-coated with silicone modified polyester coating.

1. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.

C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch (0.40 mm) thick; smooth No. 4 - Brushed finish.

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.

2.3 EXTERIOR PENETRATION FLASHING PANELS

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.4 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer Type: Zinc chromate.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 INSTALLATION

A. Comply with drawing details and SMACNA standard installation practices.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

3.3 FIELD QUALITY CONTROL

A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonsag gunnable joint sealants.
B. Joint backings and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants 2018 (Reapproved 2022).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

D. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2023.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016 (Reapproved 2023).

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2022.

G. ASTM C1311 - Standard Specification for Solvent Release Sealants 2022.

H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2023.

I. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2022).

1.3 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specific product.

3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.

4. Substrates the product should not be used on.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

E. Executed warranty.

1.4 QUALITY ASSURANCE

A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.

2. Compatibility Testing: In accordance with ASTM C1087.

3. Allow sufficient time for testing to avoid delaying the work.

4. Deliver sufficient samples to manufacturer for testing.

5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

1.5 WARRANTY

A. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:

a. Wall expansion and control joints.
b. Joints between door, window, and other frames and adjacent construction.
c. Joints between different exposed materials.
d. Openings below ledge angles in masonry.
e. Other joints indicated below.

2. Do not seal the following types of joints:

a. Intentional weep holes in masonry.

b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.

c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.

d. Joints where installation of sealant is specified in another section.

e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.

1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, noncuring.

2.2 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.3 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Nonstaining to Porous Stone: Nonstaining to light-colored Masonry when tested in accordance with ASTM C1248.

2. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

3. Color: Match adjacent finished surfaces.

B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.
4. Cure Type: Single component, neutral moisture curing.
5. Service Temperature Range: Minus 65 to 180 degrees F (Minus 54 to 82 degrees C).

C. Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant.

1. Color: White.

D. Hybrid Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Hardness Range: 15 to 25, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.
4. Service Temperature Range: Minus 75 to 300 degrees F (Minus 60 to 150 degrees C).

2.4 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.

2. Open Cell: 40 to 50 percent larger in diameter than joint width.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.
B. Verify that backing materials are compatible with sealants.
C. Verify that backer rods are of the correct size.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.3 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install bond breaker backing tape where backer rod cannot be used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.

B. Related Sections:

1. Division 00 Section - General Conditions.

2. Section 04 22 00 - Concrete Masonry Units for embedding anchors for hollow metal work into masonry construction.

3. Section 08 71 00 - Door Hardware.

4. Section 09 91 13 - Exterior Painting for field painting hollow metal doors and frames.

5. Section 09 91 23 - Interior Painting for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.

3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.

6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.

10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.

11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.

12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.

13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.

14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.

15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.

16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).
3. Pioneer Industries (PI).
4. Security Metal Products (SMP).
5. Or Approved Equal.
6. Substitutions: See 01 60 00 Product Requirements.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 38 percent.

D. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.

1. Design: Flush panel.

2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 “Laminated Core”.

a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.

b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.7, including insulated door, thermal-break frame and threshold.

c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.

3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053 inch - 1.3-mm) thick steel, Model 2.

4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).

5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".

7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:

1. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.
2. Or approved Equal.
3. Substitutions: See 01 60 00 Product Requirements.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16” positive thermal break and integral vinyl weatherstripping.

C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.

2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.

3. Manufacturers Basis of Design:

a. Curries Company (CU) – M Series.
b. Curries Company (CU) – Thermal Break TQ Series.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.

2. Manufacturers Basis of Design:

    a. CECO Door Products (C) - SU Series.
    b. Curries Company (CU) - M Series.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LOUVERS

A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.

1. Blade Type: Vision proof inverted V or inverted Y.

2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.

2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.7 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.

2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.

3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Section 08 71 00 - Door Hardware.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.

5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.

        2) Three anchors per jamb from 60 to 90 inches high.

        3) Four anchors per jamb from 90 to 120 inches high.

        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.

2) Four anchors per jamb from 60 to 90 inches high.

3) Five anchors per jamb from 90 to 96 inches high.

4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Section 08 71 00 - Door Hardware.

11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00 - Door Hardware.

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.

4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Section 08 80 00 - Glazing and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.

B. Related Sections:

1. Section 08 11 13-Hollow Metal Doors and Frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

D. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.

    b. Manufacturer of each item.

    c. Fastenings and other pertinent information.

    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

    e. Explanation of abbreviations, symbols, and codes contained in schedule.

    f. Mounting locations for door hardware.

    g. Door and frame sizes and materials.

    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

D. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Five years for manual overhead door closer bodies.
4. Twenty five years for manual overhead door closer bodies.
5. Five years for motorized electric latch retraction exit devices.
6. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.

b. Three Hinges: For doors with heights 61 to 90 inches.

c. Four Hinges: For doors with heights 91 to 120 inches.

d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.

b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.

b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

    a. Hager Companies (HA).
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
    c. Stanley Hardware (ST).

B. Pivots: ANSI/BHMA A156.4, Grade 1, certified. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.

1. Manufacturers:

    a. Architectural Builders Hardware (AH).
    b. Rixson Door Controls (RF).

2.3 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy. Manufacturer shall be based in the United States of America.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.

2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.

4. Tubular deadlocks and other auxiliary locks.

5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

6. Keyway: Match Facility Restricted Keyway.

C. Interchangeable Cores: Provide small format interchangeable cores as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Permanent Cores: Match standard. Reference Division 01 for material required under project. Installation to be included under Division 08 "Door Hardware" base bid package.

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented

key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents.

1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.

2. Manufacturers:

    a. Medeco (MC) - X4.
    b. No Substitution.

F. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.

2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.

3. New System: Key locks to a new key system as directed by the Owner.

G. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

H. Construction Keying: Provide construction master keyed cylinders.

I. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

2. Provide transcript list in writing or electronic file as directed by the Owner.

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Where specified, provide status indicators with highly reflective color and wording for "locked/unlocked" or "vacant/occupied" with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1" x 0.6" with a curved design allowing a 180 degree viewing angle with protective covering to prevent tampering.

2. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ML2000 Series.

b. Sargent Manufacturing (SA) - 8200 Series.
c. Schlage (SC) - L9000 Series.

2.5 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.6 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - DC8000 Series.
    b. LCN Closers (LC) - 4040 Series.
    c. Norton Door Controls (NO) - 7500 Series.
    d. Sargent Manufacturing (SA) - 1431 Series
    e. Sargent Manufacturing (SA) - 351 Series.

C. Door Closers, Overhead Concealed (Narrow Profile): ANSI/BHMA 156.4 Grade 1 Certified Products Directory (CPD) listed door closers designed for narrow profile frames and doors. Closers to have fully concealed body in the frame head for offset hung applications, with separate and independent valves for closing speed and backcheck adjustments and a decorative cover plate.

1. Manufacturers:

    a. Rixson Door Controls (RF) - 91DCP Series.

2.7 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

2.8 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

    a. Rixson Door Controls (RF).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Sargent Manufacturing (SA).

2.9 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

2.10 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.11 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted.

Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

2. Submit documentation of incomplete items in the following formats:

    a. PDF electronic file.

    b. Electronic formatted file integrated with the Openings Studio™ door opening management software platform.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RF - Rixson
4. RO - Rockwood
5. SA - SARGENT
6. MC - Medeco
7. NO - Norton
8. SU - Securitron

Hardware Sets

Set: 1.0

2	HINGE (HEAVY WEIGHT)	T4A3386 X NRP 4.5 X 4.5	US32D	MK
1	DOOR CLOSER	PR7500	689	NO
1	KICK PLATE	K1050 10X1.5LDW CSK BEV	US32D-316	RO
1	DOOR STOP	463-RKW	US32D	RO
1	RAIN GUARD	346C		PE
1	GASKETING	S44GR		PE
1	SWEEP	315SSN 36"		PE
1	MORTICE LOCK SET			

END OF SECTION

SECTION 08 91 19 - FIXED LOUVERS

PART 1 GENERAL

1.1 DESCRIPTION

A. SCOPE:

1. This Section includes intake and exhaust stationary air louvers and accessories.

B. Section Includes:

1. Louvers
2. Screens

C. Related Sections

1. Section 05 50 00 - Metal Fabrications
2. Section 09 90 00 - Painting and Coating

1.2 SUBMITTALS

A. Manufacturer's catalog and/or other data confirming conformance to specified design, material, and equipment requirements.

B. Certified results of pressure drop test data and water penetration data. The equipment list should identify each louver with an equipment number and indicate the room or structure in which it is located.

C. Louvers shall bear the AMCA certified ratings seal for both air performance and water penetration.

1.3 REFERENCE STANDARDS

A. Aluminum Association (AA):

1. AA 45 - Designation System for Aluminum Finishes.

B. Air Movement and Control Association (AMCA) International:

1. AMCA Standard 500 - Test Methods for Louvers, Dampers, and Shutters.

C. ASTM International (ASTM):

1. ASTM B221 - Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

2. ASTM E 90 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Greenheck
B. Ruskin Manufacturing
C. Or approved equal

2.2 MATERIALS

A. Frame: ASTM B221, 6063-T52 extruded aluminum alloy
B. Fasteners: Aluminum
C. Bird Screen

2.3 EQUIPMENT

A. BLADES:

1. Material: ASTM B221, 6063-T52 extruded aluminum alloy

2. Blades shall be of the combination of fixed and adjustable, drainable type with interlocking blade braces to provide an uninterrupted horizontal line.

3. Blades for all louvers shall be minimum 0.081-inch thick.

4. Slideable interlocked mullions shall have provisions for expansion and contraction.

B. FRAME:

1. Material: ASTM B221, 6063-T52 extruded aluminum alloy

2. The frame shall be minimum 0.081-inch thick by 4 inches deep.

3. The louver frame shall be assembled by welding.

4. The head, sill, and jamb shall be one-piece structural members and shall have an integral calking slot and retaining bead.

C. SCREEN:

1. Material: Aluminum wire mesh

2. The louver shall be furnished with a removable bird screen constructed of 1/2-inch mesh, 16-gauge wire and secured within a 10-gauge extruded aluminum frame.

3. The screen shall be mounted on the interior louver face but independent of the louver.

D. Fasteners: Aluminum.

1. Unless otherwise specified, all louvers shall receive an AAMA 2605, 70 percent fluoropolymer paint finish after assembly.

2. Minimum coating thickness shall be 0.7-mil.

3. Color to match door.

E. Sound Data: Tested in accordance with ASTM E 90.

Octave BandFrequency (Hz)	2/125	3/250	4/500	5/1000	6/2000	7/4000
Free Field Noise Reduction (dB)	10	10	12	16	23	18
Transmission Loss (dB)	4	4	6	10	17	12

2.4 FABRICATION

A. General: Fabricate louvers to comply with requirements indicated for design, dimensions, materials, joinery, and performance.

B. Assemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Maintain equal louver blade spacing to produce uniform appearance.

E. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances of louvers, adjoining construction and perimeter sealant joints.

F. Include supports, anchorages and accessories required for complete assembly.

G. Provide vertical mullions of type and at spacing's indicated but not more than recommended by manufacturer, or 72 inches on center, whichever is less. At horizontal joints between louver units, provide horizontal mullions except where continuous vertical assemblies are indicated.

H. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

I. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary:

1. With fillet welds, concealed from view.

2. With fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Locate and place louver units plumb, level, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make required alterations and refinish entire unit, or provide new units.

F. Protect nonferrous metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that are in contact with concrete, masonry or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers and insulation, as louver installation progresses, where required to make louver joints weathertight.

3.2 FINISHING

A. Adjusting and Protection

1. Protect louvers from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.

2. Restore louvers damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by the OWNER, remove damaged units and replace with new units.

a. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

B. Cleaning

1. Periodically clean exposed surfaces of louvers that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

2. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Rinse surfaces thoroughly and dry.

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 GENERAL

1.1 GENERAL

A. This specification is applicable to coated pipe, steel, concrete and other surfaces listed in the coating schedule at the end of this Section.

B. Work under this Section shall include the protective coating of all specified surfaces including all surface preparation, pretreatment, coating application, touch-up of factory coated surfaces, protection of surfaces not to be coated, cleanup, and appurtenant work, all in accordance with the requirements of the Contract Documents.

C. The Coating System Schedules summarize the surfaces to be coated, the required surface preparation and the coating systems to be applied. Coating notes on the DRAWINGS are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

D. Related Work Specified in Other Sections -- Shop coatings and/or factory finishes on fabricated or manufactured equipment may be specified in other divisions. Some items with factory finishes, or corrosion resistant finishes may be scheduled or directed to be painted by the ENGINEER to unify a wall finish or color scheme, at the ENGINEER's discretion.

E. Exclusions -- Do not coat the following surfaces unless specified or directed elsewhere: Stainless steel, aluminum, copper, brass, bronze and other corrosion-resistant material (except for valve bodies and piping); Electrical switch-gear and motor control centers having factory finish; Fencing; Multiple coated factory finished baked enamel or porcelain products; Concealed areas such as ducts, piping, conduits and items specified elsewhere for special linings and coatings.

F. Damaged Factory Finish -- If directed by the ENGINEER, refinish the entire exposed surfaces of equipment chipped, scratched or otherwise damaged in shipment or installation.

G. All coating coming in contact with potable water shall be NSF approved.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. "Architectural Specification Manual" by the Painting and Decorating Contractors of America (PDCA), 333 Taylor Avenue North, Seattle, Washington 98109.

2. "Systems and Specifications" - Volume 2 of Steel Structures Painting Council (SSPC).

3. National Sanitation Foundation (NSF) Standard No. 61.

B. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 986, Katy, TX 77450.

C. Pipe Coating Commercial Standards

ANSI/AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
ANSI/AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
ANSI/AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4-inch and Larger - Shop Applied
ANSI/AWWA C209	Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Pipelines.
ANSI/AWWA C210	Liquid Epoxy Coating for Exterior and Interior of Steel Pipe.
ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
ANSI/AWWA C214	Tape Coating systems for the Exterior of Steel Water Pipelines.

D. Federal Specifications

DOD-P-23236A(SH)	Military Specification, Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast.

1.3 CONTRACTOR SUBMITTALS

A. Coating Materials List -- The CONTRACTOR shall provide a coating materials list which indicates the manufacturer and the coating number, keyed to the coating systems herein. The amount of copies to submit shall be as specified within Division 01- General Requirements.

B. Coating Manufacturer's and Applicator Information -- For each coating system to be used the CONTRACTOR shall submit, the following listed data.

1. Manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.
2. Manufacturer's instructions and recommendations on surface preparation and application.
3. Colors available for each product and each coat.
4. Compatibility of shop and field applied coatings (where applicable).
5. Material safety data sheet (MSDS) for each product used.
6. The manufacturer’s recommended products and procedures for field coating repairs and field preparation of field cut pipe ends.
7. The name of the proposed coating applicator shop along with certification that the applicator shop is qualified and equipped to apply the coatings systems as specified.

8. Certificate -- Submit manufacturer's certificate of compliance with the SPECIFICATIONS and standards signed by a representative in the manufacturer's employ.

9. Samples -- Provide painted surface areas at the job for approval of main color selections, or submit sample on 12-inch sample of substrate using required finish system at ENGINEER's discretion.

1.4 QUALITY ASSURANCE

A. Painter Qualifications – The Painting/Coating CONTRACTOR must be capable of performing the various items of work as specified. The Painting/Coating CONTRACTOR shall furnish a statement covering experience on similar work, a list of machinery, plant and other equipment available for the proposed work, and a financial statement, including a complete statement for the Painter/Coating CONTRACTOR's financial ability and experience in performing similar painting and coating work. The Painting/Coating CONTRACTOR shall have a minimum of five (5) years practical experience and a successful history in the application of the specified products to concrete/steel surfaces. Upon request, the Painting/Coating CONTRACTOR shall substantiate this requirement by furnishing a list of references, which shall include jobs of similar nature.

B. The CONTRACTOR shall give the ENGINEER a minimum of three (3) days advance notice of the start of any field surface preparation work of coating application work, and a minimum of seven (7) days advance notice of the start of any shop surface preparation work.

C. All such work shall be performed only in the presence of the ENGINEER, unless the ENGINEER has granted prior approval to perform such work in its absence.

D. Inspection by the ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve the CONTRACTOR of its responsibility to perform the work in accordance with these SPECIFICATIONS.

E. Surface Preparation -- Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70.

F. Scaffolding shall be erected and moved to locations where requested by the ENGINEER to facilitate inspection. Additional illumination shall be provided by the CONTRACTOR to cover all areas to be inspected.

G. Paint Products -- No request for substitution shall be approved which decreases the film thickness designated or the number of coats to be applied, or which offers a change from the generic type of coating specified. Painting shall be done at such times as the CONTRACTOR and ENGINEER may agree upon in order that dust-free and neat work be obtained. All painting shall be in strict accordance with the manufacturer's instructions and shall be performed in a manner satisfactory to the ENGINEER.

H. Manufacturer's Representative -- Require coating manufacturer's representative to be at job site when the first day's coating application is in progress and periodically during progress of the work.

I. Labels -- Deliver to the job site in the original sealed containers with manufacturer's name, product name, type of product, manufacturer's specification or catalog number or federal specification number, and instructions for reducing where applicable.

J. Colors -- Colors will be selected from manufacturer's standard colors as reviewed by ENGINEER and approved by the OWNER. Colors for special coatings that are limited in their availability and color selection will be chosen on the basis of manufacturer's standard colors, provided that the manufacturer's product line represents a color range comparable to similar products of other manufacturers.

K. Flame Spread -- Provide paint materials which will result in a Class II finish for all coated surfaces in exit corridors, and a Class III finish for all other interior rooms or areas.

L. Film Thickness Testing -- On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gage such as Mikrotest model FM, Elcometer model 111/1EZ, or approved equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least eight (8) hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using wet film gage readings and destructive film thickness tests.

1.5 DELIVERY, HANDLING AND STORAGE

A. Deliver in labeled containers as specified above and store in a locked room accessible for inspection. Comply with fire and health regulations.

B. Provide adequate heat and forced mechanical ventilation for health, safety and drying requirements. Use explosion proof equipment. Provide face masks.

C. Protect adjacent surfaces with suitable masking and drop cloths as required. Remove cloths or waste from the project daily.

D. Apply to surfaces under recommended environmental conditions and within the limitations established by the material manufacturer. Do not apply coating in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by the coating manufacturer's printed instructions. Coating application may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

1.6 PROTECTION

A. Follow all safety recommendations of manufacturer regarding ventilation and danger from explosion or breathing paint fumes or skin exposure, and all applicable O.S.H.A. and other regulations.

B. Protect surface adjacent to work being coated from overspray, drips or other damage.

PART 2 PRODUCTS

2.1 GENERAL

A. Definitions -- The terms "paint," "coatings" or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, tape and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. General -- Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.

C. The CONTRACTOR shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.

D. Compatibility -- In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the ENGINEER, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

E. Colors -- All colors and shades of colors of all coatings shall be as selected or specified by the ENGINEER. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the ENGINEER. Color pigments shall be lead free.

F. Protective Coating Materials -- Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the CONTRACTOR shall provide the ENGINEER with the names of not less than 10 successful applications of the proposed manufacturer's products demonstrating compliance with this specification requirement.

G. Substitute or "Or-Equal" Submittals -- Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the coatings of the companies listed. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or equal" material that said material meets the specified requirements and is equivalent or better than the listed materials.

H. The cost of all testing and analyzing of the proposed substitute materials that may be required by the ENGINEER shall be paid by the CONTRACTOR. If the proposed substitution requires changes in the contract work, the CONTRACTOR shall bear all such costs involved and the costs of allied trades affected by the substitution.

2.2 INDUSTRIAL COATING SYSTEMS

A. General

Provide and apply the industrial coatings systems which follow as listed in the coating schedule, as required by these SPECIFICATIONS and as directed by the ENGINEER. Coat all existing and

new exposed interior or exterior surfaces and submerged and intermittently submerged surfaces as indicated, except as specifically excluded in Part 1 of this Section or on the DRAWINGS or finish schedules. Coating System Numbers listed below shall be used as the Coating System code letter, and shall be used on any coating submittals or correspondence.

B. Industrial coating systems shall be as follows

1. Coating System 100

   a. Location -- Exposed, unprimed, non-galvanized, nonsubmerged metal surfaces, both interior and exterior including piping and structural steel.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply prime coat and topcoat, 4.0-6.0 mils each coat of Tnemec Series 66-2 Hi-Build Epoxoline, or approved equal. Color as selected by OWNER.

2. Coating System 101

   a. Location -- Exposed metal surfaces, shop primed, both interior and exterior including piping, railings, ladders, steel doors, and any other metal items not otherwise specified.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply shop prime coat 3.0 mils DFT Tnemec Series 90-97 Tnemec-Zinc, one coat 4.0 - 6.0 mils DFT Tnemec Series 66 Hi-Build Epoxoline, and 3.0 - 4.0 mils DFT of Tnemec Series 73 Endura Shield, or approved equal. Color as selected by OWNER.

3. Coating System 102

   a. Location -- Unprimed or non-galvanized, continuously or intermittently submerged metal items, both interior and exterior including piping, structural steel and all other metal items not otherwise specified.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prime, intermediate and topcoat, 4.0-6.0 mils each coat of Tnemec Series 20 Pota-Pox, or approved equal. Color as selected by OWNER.

4. Coating System 103

   a. Location -- Vertical concrete walls, exterior, below finish grade, not exposed to view.

   b. Surface Preparation -- As specified herein.

   c. Paint System -- Apply two coats 2.0-3.0 mils each, Kop-Coat Bitumastic Super Service Black, or approved equal.

5. Coating System 104

   a. Location - Nonsubmerged, exposed to view, PVC piping.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply one coat, 4.0-6.0 mils Tnemec Series 66-2 Hi-Build Epoxoline, or approved equal. Color as selected by OWNER.

6. Coating System 105

a. Location – Nonsubmerged, exposed to view, HDPE and polyurethane coated surfaces.

b. Surface Preparation – As specified herein.

c. Coating System – Apply two coats, 3.0 - 4.0 mils DFT of Tnemec Series 73 Endura Shield, or approved equal. Color as selected by OWNER.

2.3 SPECIAL PIPE AND SEVERE SERVICE COATING SYSTEMS

A. General

The following coatings are for buried pipe and surfaces used in severe service conditions. The manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. Proposed substitute products will be considered as indicated within the paragraph entitled " 'Or-Equal' Clause" in Division 01- General Requirements.

B. Special pipe and severe service coating systems shall be as follows:

1. Coating System 200 -- Cement Mortar Coating

a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

b. Surface Preparation - As specified herein.

c. Coating System -- A 1-1/2-inch minimum thickness mortar coating reinforced with 3/4-inch galvanized welded wire fabric shall be provided. The cement mortar shall contain no less than one part Type V cement to three (3) parts sand. The cement mortar shall be cured by a curing compound meeting the requirements of "Liquid Membrane-Forming Compounds for Curing Concrete" ASTM C 309-81, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped by at least six (6) inches. At the ENGINEER's discretion, the hot applied coal tar epoxy coating may be used as the curing membrane for the mortar coating.

2. Coating System 201 -- Hot Applied Coal Tar Epoxy Coating

a. Location -- Exterior surface of concrete pipe and cement-mortar coated pipe and fittings.

b. Surface Preparation -- As specified herein.

c. Coating System -- The hot applied coal tar epoxy shall be a solvent free 100 percent solids coal tar epoxy chemically compatible with hydrating cement and suitable for application on moist surfaces of freshly placed cement mortar or concrete and

properly prepared cured surfaces. The coal tar epoxy coating material shall be Amercoat 1972B or approved equal. The finish coal tar epoxy coating shall have a minimum DFT of 26 mils.

3. Coating System 202 -- Coal-Tar Epoxy Coating System

    a. Location -- Exterior surface of buried steel pipe, fittings and other ferrous surfaces.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- High build, 2-component amine or polyamide cured coal-tar epoxy shall have a solids content of at least 68 percent by volume, suitable as a long term coating of buried surfaces, and conforming to AWWA C210. Prime coats are for use as a shop primer only. Prime coat shall be omitted when both surface preparation and coating are to be performed in the field. The coal-tar epoxy coating system shall include:

        1) Prime coat (DFT = 1.5 mils), Amercoat 83HS, Tnemec P66, or equal.

        2) Finish coats (2 or more, DFT = 18 mils), Amercoat 78 HB, Tnemec 46 H-413, or equal.

        3) Total system DFT = 19.5 mils.

4. Coating System 203 -- Fusion Bonded Epoxy

    a. Location -- Ferrous surfaces of sleeve couplings, steel pipe and fittings.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- The coating material shall be a 100 percent powder epoxy applied in accordance with the ANSI/AWWA C213 "AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines". The coating shall be applied using the fluidized bed process.

        1) Liquid Epoxy -- For field repairs, the use of a liquid epoxy will be permitted, applied in not less than 3 coats to provide a DFT 16 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the powder epoxy manufacturer.

        2) Coating (DFT = 16 mils), Scotchkote 203, or equal.

        3) Total system DFT = 16 mils.

5. Coating System 204 -- Hot, Coal-Tar Enamel

    a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

    b. Surface Preparation - As specified herein

    c. Coating System -- Coal-Tar Enamel materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a primer layer, coal-tar enamel

layer, coal-tar saturated nonasbestos felt outerwrap and a finish coat. Total system DFT = 188 mils.

6. Coating System 205 -- Hot Applied Tape

    a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a cold-applied liquid primer and heated coal-tar base tape. Total system DFT = 50 mils.

7. Coating System 206 -- Cold Applied Tape

    a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C209. Prefabricated tape shall be Type II. The system shall consists of a primer layer, inner layer tape of 35 mils, and an outer layer tape of 35 mils. Total system DFT = 70 mils.

8. Coating System 207 -- PVC Tape

    a. Location -- Small galvanized steel pipe and fittings.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- Prior to wrapping pipe with PVC tape, the pipe and fittings shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half lapped for a total thickness of 40 mils.

9. Coating System 208 -- Mastic

    a. Location -- Pipe and fitting joints, and general buried surface coating repair and touch up.

    b. Surface Preparation - As specified herein.

    c. Coating System -- Mastic shall be a one-part solvent drying heavy bodied thixotropic synthetic elastomeric coating with chemically inert resins and fillers and an average viscosity of 650,000 CPS at 77 degrees Fahrenheit, thereby requiring generous applications by hand or trowel. Total coat thickness shall be 30 mils, minimum. Mastic shall be Protecto Wrap 160 H or approved equal and be fully compatible with pipeline coating systems.

10. Coating System 209 -- Polyethylene Encasement

    a. Location -- Ductile iron, steel and concrete cylinder pipe and fittings.

b. Surface Preparation -- None required.

c. Coating System -- Except as otherwise specified, application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.

11. Coating System -- 210

a. Location – Wet well interior concrete surfaces where shown.

b. Surface Preparation – Repair and surface prepare substrate per manufacturer's recommendations. Prepare the concrete by abrasive blasting, high pressure water cleaning, and/or approved mechanical method to achieve clean, sound, and profiled concrete (ICRI CSP-5 min). Prepare concrete in accordance with SSPC-SP 13/NACE No. 6. "Surface Preparation of Concrete."

c. Surface Repair - Stop all infiltration and repair cracks per Section 03 01 30.71.11 Concrete Rehabilitation. CONTRACTOR and ENGINEER shall inspect the surface together prior to applying the coating system.

d. Substrate Keyways – Cut a series of keyway grooves into the substrate prior to applying the liner at a spacing and depth as per manufacturer recommendation but no less than above and below each horizontal joint, above the fillet or bench, and at the top of the flow channel. The grooves shall be angled into the substrate at a 60-degree angle with a width and depth no less than 1/4 inch. At no time shall the existing reinforcement be cut or damaged during installation of the keyways.

e. Coating System – Solvent-free 100% solids, ultra-high build two-component epoxy coating system, thixotropic in nature and filled with select fillers to minimize permeability and provide sag resistance with high physical strengths and broad range of chemical resistance. Coating shall be meet these requirements:

Product type	Amine cured epoxy
Color	White
Solids Content (vol %)	100
Compressive Strength, psi	16,000 minimum
Tensile Strength, psi	7,600 minimum
Tensile Elongation, %	1.50 minimum
Flexural Modulus, psi	600,000
Bond Strength - Concrete	>Tensile Strength of Concrete
Chemical Resistance:	
Severe Municipal Sewer:	All types of service
Successful Pass:	Sanitation District of L.A. County Coating Evaulation Study or SSPWC 210.2.3.3

f. Epoxy coating system shall be applied by a certified applicator of the epoxy coating manufacturer and according to manufacturer specifications.

g. Coating shall be Raven 405, Tnemec Epoxytec CPP, or approved equal. The coating shall be applied with minimum thickness of 120 mils.

h. After application of the epoxy coating to the interior surfaces of wet well, pull-off adhesion strength testing per ASTM D7234 shall be conducted at three locations to be determined by the ENGINEER. Test results must meet or exceed 175 psi bonding strength to be considered passing. If there are failed test results, it will be the responsibility of the CONTRACTOR to conduct additional pull-off adhesion strength testing to determine the limits of the failed coating area. Once the limits of failed epoxy coating are determined and reviewed with the ENGINEER, it will be the responsibility of the CONTRACTOR to remove the failed epoxy coating to the limits of the coating not meeting the adhesion requirements and to where satisfactory coating is encountered, repair any concrete damage, re-apply epoxy coating following coating manufacturers recoat requirements, and retest epoxy coating per ASTM D7234. All costs associated with additional testing, epoxy coating removal, concrete repair, epoxy coating re-application, and retesting of re-applied epoxy coating shall be borne by the CONTRACTOR.

12. Coating System 211

    a. Location – Force main discharge manholes interior concrete surfaces.

    b. Surface Preparation – Per manufacturer's requirements, pressure wash concrete interior and apply non-shrink grout to all voids prior to coating application. Perform the manufacturers 7-point checklist evaluation and fill any cracks with a chemical or hydraulic sealant designed for sealing and stopping ground water. Surface shall be clean and free of all foreign materials.

    c. Coating System – Solvent-free 100% solids, self-priming polyurethane coating system, thixotropic in nature and filled with select fillers to minimize permeability and provide sag resistance with high physical strengths and broad range of chemical resistance. Coating shall be meet these requirements:

Compressive Strength, psi	18,000
Tensile Strength, psi	7,450
Tensile Elongation, %	<4%
Flexural Modulus, psi	735,000
Adhesion	Excellent
Superior Corrosion Resistance	

    d. Polyurethane liner coating system shall be applied by a certified applicator of the manufacturer and according to manufacturer specifications.

    e. Coating system shall be Sprayroq system using a spray on self-priming polyurethane mixture.

13. Coating System -- 212

    a. Location – Wet well interior existing coating system repair

    b. Surface Preparation – Repair and surface prepare substrate per manufacturer's recommendations. This includes a hydroblasting at 3,000 psi pressure with a 5% TSP solution to remove all loose concrete and debris from the concrete surface. Stop all

infiltration and repair cracks per Section 03 01 30.71.11 Concrete Rehabilitation. CONTRACTOR and ENGINEER shall inspect the surface together prior to applying the coating system.

c. The lining system to be utilized for wastewater structures shall be a multi-layer 'stress skin panel' liner system as described below:

1) Liner:

Installation	Liner
Moisture barrier	Modified Polymer (Silicone modified polyurea)
Surfacer	Polyurethane/Polymeric blend foam
Final corrosion barrier	Modified Polymer (Silicone modified polyurea)

2) The Modified Polymer (Silicone modified polyurea) shall be sprayable, solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the corrosive wastewater environment.

3) The Polyurethane Rigid Structure Foam, shall be low viscosity two-component, containing flame retardants.

4) Total thickness of multi-layer liner system shall be a minimum of 500 mils. Apply a barrier coating with a minimum thickness of 50 mil over sound existing liners.

d. The product shall be SPECTRASHIELD, manufactured by CCI Spectrum, Inc. or approved equal.

2.4 ARCHITECTURAL COATING SYSTEMS

A. General

"Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or topcoat.

Fungus Control: Submit evidence for all paints attesting the passing of Federal Test Method Standard No. 141, Method 6271.1 showing no fungus growth or other approved test results.

Apply to surfaces under recommended environmental conditions and within the limitations established by the material manufacturer. Acrylics require 60 degrees Fahrenheit (°F) and above temperature and below 50 percent relative humidity. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50°F and 90°F unless otherwise permitted by the paint manufacturer's printed instructions.

B. Architectural coating systems shall be as described in specification 09 91 13 – Exterior Painting and 09 91 23 – Interior Painting.

PART 3 EXECUTION

3.1 STORAGE, MIXING AND THINNING OF MATERIALS

A. Manufacturer's Recommendations -- Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. Storage and Mixing -- Coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.2 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification.

1. Solvent Cleaning (SSPC-SP1) -- Removal of oil, grease, soil, salts and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion or steam.

2. Hand Tool Cleaning (SSPC-SP2) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing and grinding.

4. White Metal Blast Cleaning (SSPC-SP5) -- Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.

5. Commercial Blast Cleaning (SSPC-SP6) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6. Brush-Off Blast Cleaning (SSPC-SP7) -- Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust and loose paint.

7. Near-White Blast Cleaning (SSPC-SP10) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

3.3 CORRECTIONS AND CLEANUP

At completion any damaged, de-laminated or defaced coated surfaces shall be touched up, restored and left in first class condition. Any coated or finished surfaces damaged in fitting or erection shall be restored. If necessary, an entire wall shall be refinished rather than spot finished. Upon completion and prior to final acceptance, all equipment and unused materials accumulated in the

coating process shall be removed from the site and any spillage, spatter spots or other misplaced coating material shall be removed in a manner which will not damage surfaces. Perform required patching, repair and cleaning to the satisfaction of the ENGINEER. Cooperate and coordinate work with the work of other trades in the removal and replacement of hardware, fixtures, covers, switch plates, etc., as required for coating.

3.4 SURFACE PREPARATION

A. General

Prepare all surfaces scheduled to receive new coating systems, as required to provide for adequate bonding of the specified coating system to the substrate material. Request review of prepared surfaces by the ENGINEER prior to proceeding. For existing coated surfaces, hand wash with cleaner or product recommended by coating manufacturer to properly prepare existing surface and provide for bonding of coating specified to follow. Remove any loose, peeling or flaking coating, or mildewed areas. Surface preparation minimums shall be as follows:

1. Exposed metal items, nonsubmerged, unprimed, non-galvanized both interior and exterior, including: piping, structural steel and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP6, "Commercial Blast Cleaning".

2. Exposed metal items, shop primed, both interior and exterior including: piping, steel doors, steel ladders to be painted, and railings, and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning"; SSPC-SP2, "Hand Tool Cleaning"; and SSPC-SP3, "Power Tool Cleaning" as may be required to remove grease, loose or peeling or chipped paint.

3. Metal items, unprimed or non-galvanized, continuously or intermittently submerged, both interior and exterior including: piping, structural steel and all other metal items not otherwise specified, shall undergo surface preparation in conformance with SSPC-SP10, "Near-White Blast Cleaning".

4. Stainless Steel - Nonsubmerged and submerged, exposed piping and fittings, both interior and exterior shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning".

5. Polyvinyl Chloride (PVC) - Nonsubmerged, both interior and exterior, process piping and plumbing, shall be lightly sanded prior to application of the specified coating system to follow.

6. Nonsubmerged Concrete - Clean all concrete surfaces of dust, form oil, curing compounds or other incompatible matter. Etch and prime if required by manufacturer for specified coating products to follow. Allow minimum 28-day cure of concrete prior to application of coating systems.

7. Wet Well Concrete –

    a. All contaminants including: oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall

be removed. All concrete or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface or replaced.

b. Infiltration shall be stopped by using a material which is compatible with the repair materials and is suitable for top coating with epoxy coating.

c. Cementitious repair materials shall be troweled to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the epoxy coating. No bugholes or honeycomb surfaces should remain. The repair materials shall be permitted to cure according to manufacturer recommendations.

d. Curing compounds should not be used unless approved for compatibility with the specified epoxy coating.

8. Preparation of All Existing Coated Surfaces -- Removed rough and defective coating film from material surfaces to be painted. Touch up with approved primer. Clean all greasy or oily surfaces, to be painted, with benzine or mineral spirits or Rodda's Gresof before coating, or as recommended by manufacturer. For walls, patch existing nicks and gouges, sand to match wall finish.

3.5 PRIME COATING

A. Exposed Steel -- Prime coat all exposed steel in accordance with SSPC PS 13.01 for epoxy-polyamide coating systems. Prime coats shall be applied following completion of surface preparation requirements as specified in paragraph 3.4.A.1 above.

B. Galvanized Metal -- After surface preparation specified above, prime galvanized metal items receiving paints as specified with Tnemec Series 66 Hi-Build Epoxaline or equal, verifying with manufacturer before application the compatibility with coatings specified to follow.

C. Shop Primed Metal -- Where indicated on the plans or coating schedule and following the surface preparation procedures specified in paragraph 3.4.A.2 above, the CONTRACTOR shall apply intermediate and topcoats of the specified paint system to shop primed metal. The CONTRACTOR shall verify with the manufacturer(s) representative of the item(s) to be painted, before application, the compatibility of shop primers with the specified intermediate and topcoat coating systems.

D. Non-Shop Primed Metal and Piping -- Prime coat all exposed metal and piping, except stainless steel, received at job site following completion of surface preparation requirements as specified in paragraph 3.4.A.1 above. Prime paint in accordance with SSPC PS No. 13.01 for epoxy-polyamide primers. Epoxy-polyamide primers shall conform to the standards set forth in SSPC Paint Specification No. 22.

E. Cast-In-Place Reinforced Concrete -- After surface preparation specified above, prime coat concrete as specified in the coating schedule found elsewhere in the SPECIFICATIONS.

F. Concrete Masonry Units -- After surface preparation specified above, prime coat as specified in the coating schedule found elsewhere in the SPECIFICATIONS.

G. Wood Surfaces -- Following surface preparation specified above, prime coat exterior exposed wood surfaces with appropriate coating system as specified in the painting schedule.

3.6 FIELD PRIME

Wherever shop priming has been damaged in transit or during construction, the damaged area shall be cleaned and touched up with field primer specified herein or returned to the shop for resurfacing and repriming, at the ENGINEER's discretion. Metal items delivered to the job site unprimed shall be cleaned and primed as specified herein.

3.7 APPLICATION

A. Thickness -- Apply coatings in strict conformance with the manufacturer's application instructions. Apply each coat at the rate specified by the manufacturer to achieve the dry mil thickness specified. If material must be diluted for application by spray gun, build up more coating to achieve the same thickness as undiluted material. Correct apparent deficiency of film thickness by the application of an additional coat.

B. Porous Surfaces -- Apply paint to porous surfaces as required by increasing the number of coats or decreasing the coverage as may be necessary to achieve a durable protective and decorative finish.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe coating for these areas.

F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

G. Ventilation -- Adequately ventilate enclosed rooms and spaces during painting and drying periods.

H. Drying Time -- Do not apply next coat of coat until each coat is dry. Test non-metallic surfaces with moisture meter. The manufacturer's recommended drying time shall mean an interval under normal condition to be increased to allow for adverse weather or drying conditions. Coating manufacturer's representative shall verify by cure testing, complete cure of coatings systems used for immersion service.

3.8 COATING SCHEDULE

Provide protective coatings in accordance with following Coating Schedule:

South Welches Pump Station Coating Schedule

Item	Location	Material	Coating System
Piping[1]	Exposed in Bypass Vault	Ductile Iron	Coating System 101

Piping	In Wet Well (exterior surface)	Ductile Iron	Coating System 102
Piping	Buried	Ductile Iron	See Note 4
Valves & Couplings[2]	All	--	See Note 2
Concrete Wet Well	Interior	Concrete	Coating System 210
Miscellaneous Metals	Exposed Surfaces, Exterior and Interior	Non-Stainless Steel, Galvanized Steel	Coating System 101 (color to match exist)

Golf Club Terrace Pump Station Coating Schedule

Item	Location	Material	Coating System
Piping[1]	Exposed in Bypass Vault	Ductile Iron	Coating System 101
Piping	In Wet Well (exterior surface)	Ductile Iron	Coating System 102
Piping	Buried	Ductile Iron	See Note 4
Valves & Couplings[2]	All	--	See Note 2
Concrete Wet Well	Interior	Concrete	Coating System 210
Miscellaneous Metals	Exposed Surfaces, Exterior and Interior	Non-Stainless Steel, Galvanized Steel	Coating System 101 (color to match exist)

82nd Drive Pump Station Coating Schedule

Item	Location	Material	Coating System
Piping[1]	Exposed in Bypass Vault	Ductile Iron	Coating System 101
Piping	In Wet Well (exterior surface)	Ductile Iron	Coating System 102
Piping	Buried	Ductile Iron	See Note 4
Valves & Couplings[2]	All	--	See Note 2
Concrete Wet Well	Interior	Concrete	Coating System 210
Miscellaneous Metals	Exposed Surfaces, Exterior and Interior	Non-Stainless Steel, Galvanized Steel	Coating System 101 (color to match exist)

Sieben Lane Pump Station Coating Schedule

Item	Location	Material	Coating System
Piping[1]	Exposed in Bypass Vault	Ductile Iron	Coating System 101
Piping	In Wet Well (exterior surface)	Ductile Iron	Coating System 102
Piping	Buried	Ductile Iron	See Note 4
Valves & Couplings[2]	All	--	See Note 2
Concrete Wet Well	Interior	Concrete	Coating System 210
Miscellaneous Metals	Exposed Surfaces, Exterior and Interior	Non-Stainless Steel, Galvanized Steel	Coating System 101 (color to match exist)

Notes:

1 Pipe linings shall be as specified elsewhere in these SPECIFICATIONS.

2 Coating of exposed valves and couplings to be shop-applied fusion-bonded epoxy. Finish coat shall be same coating system as adjacent piping to match in color and total mil thickness, unless otherwise directed by the ENGINEER

3 Refer to other specification sections for coating requirements of specific equipment and items.

4.Lining and Coating for buried ductile iron piping and fittings shall be as specified in Section 33 31 10 Sanitary Utility Sewerage Piping.

5. Painting and coating of architectural elements shall be as specified in Sections 09 91 13 Exterior Painting and 09 91 23 Interior Painting.

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

2. Items indicated to receive other finishes.

3. Items indicated to remain unfinished.

4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

5. Floors, unless specifically indicated.

6. Glass.

7. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting.

1.3 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

C. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

D. SSPC-SP 6 - Commercial Blast Cleaning 2007.

E. SSPC-SP 13 - Surface Preparation of Concrete 2018.

1.5 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

4. Manufacturer's installation instructions.

5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

2. Allow 30 days for approval process, after receipt of complete samples by Architect.

3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.

B. Paints:

1. Behr Process Corporation: www.behr.com/#sle.

2. Cloverdale Paint, Brand Products of Rodda Paint Company : www.cloverdalepaint.com/#sle.

3. Diamond Vogel Paints: www.diamondvogel.com/#sle.

4. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.

5. PPG Paints: www.ppgpaints.com/#sle.

6. Prosoco, Inc.: www.prosoco.com

7. Rainguard Brands, LLC.: www.rainguardpro.com

8. Rodda Paint Company: www.roddapaint.com/#sle.

9. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Supply each paint material in quantity required to complete entire project's work from a single production run.

3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

2.3 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Primed Metal.

1. Two top coats and one coat primer.

2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.

a. Products:

1) Behr Marquee Exterior Satin Enamel [No. 9450]. (MPI #15)
2) PPG Paints Speedhide Exterior Latex Satin, 6-2045XI Series. (MPI #15)
3) Rodda Protector Satin, 532201. (MPI #15)

B. Paint S-GR - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Sealer and Graffiti Control: Concrete, Concrete Masonry Units.

C. Top Coat(s) and surface prep: per Manufacturer Recommendation:

1. Products:

a. Prosoco, Inc.: Sure Klean Weather Seal Blok-Guard & Graffiti Control 15
b. Rainguard Brands, LLC: Micro-Seal
c. Fabrishield: Paint Repellent PR 61
d. or approved equal
e. Substitutions: See 01 60 00 Product Requirements.

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Anti-Corrosive Alkyd Primer for Metal; MPI #79.

a. Products:

1) PPG Paints: 4160 Series Multiprime Multi-Purpose Primer. (MPI #23, #76, #79, #95)

2) Rodda Barrier III HS Metal Primer, 708295. (MPI #79)

3) Or Approved Equal.

4) Substitutions: See 01 60 00 Product Requirements.

2. Water Based Primer for Galvanized Metal; MPI #134.

a. Products:

1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #134)

2) PPG Paints: 4020 PF Pitt-Tech Plus Interior/Exterior Waterborne Acrylic Primer Finish DTM Industrial Enamel. (MPI #134).

3) Sherwin-Williams DTM Primer/Finish (MPI #134)

4) Or Approved Equal.

5) Substitutions: See 01 60 00 Product Requirements.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

G. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

2. Prepare surface as recommended by top coat manufacturer.

H. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.

2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.

I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.

3.6 COLOR SCHEDULE

A. See Finish Schedule on drawings.

END OF SECTION

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SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.

2. Prime surfaces to receive wall coverings.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

2. Items indicated to receive other finishes.

3. Items indicated to remain unfinished.

4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.

5. Floors, unless specifically indicated.

6. Ceramic and other tiles.

7. Glass.

8. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 09 91 13 - Exterior Painting.

1.3 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2020.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

F. SCAQMD 1113 - Architectural Coatings 1977, with Amendment (2016).

1.5 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

1.6 QUALITY ASSURANCE

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

1. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.

B. Paints:

1. Behr Process Corporation: www.behr.com/#sle.
2. Miller Paint Company: www.millerpaint.com

3. PPG Paints: www.ppgpaints.com/#sle.
4. Rodda Paint Co: www.roddapaint.com/#sle.
5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
6. Or Approved Equal..
7. Substitutions: See 01 60 00 Product Requirements

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Supply each paint material in quantity required to complete entire project's work from a single production run.

3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

b. SCAQMD 1113 Rule.

c. CARB (SCM).

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Color: Basis of Design: Miller 0558 Queen Annes Lace.

2.3 PAINT SYSTEMS - INTERIOR

A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including wood.

1. Two top coats and one coat primer.

2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.

3. Top Coat Sheen: Satin

B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:

1. Medium duty applications include doors and door frames.

2. Two top coats and one coat primer.

3. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153, or 154.

4. Top Coat Sheen:

a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations unless otherwise noted..

5. Primer: As recommended by top coat manufacturer for specific substrate.

C. Transparent Finish on Concrete Floors.

1. 1 coat stain.

2. Sealer: Water Based Sealer for Concrete Floors; MPI #99.

3. Sealer Sheen:

a. Eggshell: MPI gloss level 3; use this sheen at all locations.

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
2. Interior/Exterior Latex Block Filler; MPI #4.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
4. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

F. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

2. Prepare surface as recommended by top coat manufacturer.

G. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

I. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

J. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood and metal surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.

END OF SECTION

SECTION 10 14 10 - IDENTIFYING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the work necessary to furnish and install, complete, identifying devices for the Project.

B. Section includes:

1. Process pipe color coding and labeling
2. Process equipment nameplates
3. Door and warning signs

1.2 RELATED SECTIONS:

A. Section 40 05 13 - Common Work Results for Process Piping

1.3 STANDARDS, SPECIFICATIONS, AND CODES

A. All safety related signs, markers, labeling, and symbols shall conform to the applicable provisions or codes of the Occupational Safety and Health Administration (OSHA), unless specifically modified hereinafter.

B. All signage providing emergency information or general circulation directions, or identifies rooms for the physically handicapped, shall comply with the requirements of the latest edition of American National Standards Institute (ANSI A117.1).

1.4 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Procedures.

B. Manufacturer's Data - Specifications and installation instructions for each type of sign required.

C. Samples - Submit three full size samples of each color and finish of pipe labeling, process equipment nameplates, and warning signs with sample letters.

1. ENGINEER's review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the CONTRACTOR.

2. Submit samples of any other special identifying or signing provided for elsewhere in this specification.

PART 2 PRODUCTS

2.1 PIPE LABELING AND COLORS

A. Unless noted otherwise on the DRAWINGS or specified differently hereinafter, pipe labeling and colors shall conform to the following schedule:

Service	Symbol (label)	Symbol Color (label)	Pipe Color
Potable Water	PW	White	-
Non-Potable Water	NPW	Green	-
Drains	D	White	Gray
Raw Sewage	S (Sewage)	Black text over Yellow Backgrounds	Tan
Vents	V	Black	Green
Misc. Piping	As directed by the ENGINEER	As directed by the ENGINEER	As directed by the ENGINEER

B. Pipe identification labels and flow direction arrows shall consist of lettering and symbols applied over the pipe base color.

C. Coating systems and surface preparation requirements used in color coding piping and lettering and flow arrows shall be as specified in Section 09 90 00, Painting and Coating.

2.2 PROCESS EQUIPMENT NAMEPLATES

A. Nameplates shall be used to identify all process equipment including but not limited to pumps, chlorinators, control panels, and any other equipment requiring identification as directed by the ENGINEER.

B. Fabricated from 1/16-inch thick satin-surfaced Setonply, all edges beveled neatly.

C. Furnish with drilled holes for mounting to the appropriate equipment or nearest adjacent surface. As an alternative, acceptable adhesive attachment methods may be used if approved by the ENGINEER.

D. Nameplate background color, lettering color, and wording shall be as directed by the ENGINEER and approved by the OWNER.

E. Minimum Size: 4-inch x 1-1/2-inch.

F. Manufacturer: Seton Nameplate Company, New Haven, CT, Style 2060-40 or approved equal.

2.3 CONFINED SPACE WARNING SIGNS

A. Painted aluminum with a yellow background and black lettering.

B. Each sign shall contain the following wording:

"DANGER
PERMIT-REQUIRED CONFINED SPACE
DO NOT ENTER"

PART 3 EXECUTION

3.1 PIPE LABELS AND FLOW DIRECTION ARROWS

A. Location: At all connections to equipment, valves, branching fittings, at wall boundaries, and at intervals along the piping not greater than 5 feet on center with at least one label applied

to each exposed horizontal and vertical run of pipe. Exposed piping not normally in view, such as behind ceilings and in closets and cabinets, shall also be labeled.

B. Labels shall not be applied to the pipe until all pipe painting is complete or as approved by the ENGINEER.

C. Application: By adhesive tape stickers over pipe base coat. Base coat shall be cured, clean, and dry, prior to adherence of lettering.

D. Lettering sizes for pipe labels shall be in accordance with ANSI A13.1, Table 3, and based upon the outside diameter of the pipe to which they are applied.

E. Stripes on solution pipe shall be applied at intervals along the piping not greater than 5 feet on center with at least one stripe applied to each exposed horizontal and vertical run of pipe.

3.2 PROCESS EQUIPMENT NAMEPLATES

A. Location: As directed by the ENGINEER.

B. Mounting of process equipment nameplates shall be in accordance with the manufacturer's instructions, and as directed by the ENGINEER.

3.3 PAINTED SIGNS

A. Prepare and mask base material as required to provide clean surface for application of letters by stencil.

B. Unless otherwise noted, color of letters shall be black.

C. Paint Type: Semi-gloss alkyd enamel.

3.4 CONFINED SPACE WARNING SIGNS

A. Securely fasten signs to the underside of all hatches entering vaults such that the sign can be read when the hatch is opened.

END OF SECTION

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SECTION 11 05 00 - COMMON WORK RESULTS FOR EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Provide all tools, supplies, materials, equipment and all labor necessary for the furnishing, construction, installation, testing and operation of equipment and appurtenant work, complete and operable, all-in accordance with the requirements of the Contract Documents.

B. The provisions of this Section shall apply to all equipment specified and where referred to, except where otherwise specified or shown.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. All equipment, products and their installation shall be in accordance with the following standards, as applicable and as specified in each section of these specifications:

1. American Society for Testing and Materials (ASTM)
2. American Public Health Association (APHA)
3. American National Standards Institute (ANSI)
4. American Society of Mechanical Engineers (ASME)
5. American Water Works Association (AWWA)
6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
7. American Welding Society (AWS)
8. National Fire Protection Association (NFPA)
9. Federal Specifications (FS)
10. National Electrical Manufacturers Association (NEMA)
11. Manufacturer's published recommendations and specifications
12. Oregon Occupational Safety and Health Division (OR-OSHA)

B. The following standards have been referred to in this Section of the specifications.

1. ASTM International:

   a. ASTM A48 - Specification for Gray Iron Castings.
   b. ASTM A108 - Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.

2. American National Standards Institute (ANSI):

   a. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

   b. ANSI B16.5 - Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy and Other Special Alloys.

   c. ANSI B46.1 - Surface Texture.

   d. ANSI S12.6 - Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors.

3. American Society Mechanical Engineers (ASME):

    a. ANSI/ASME B1.20.1 - General Purpose Pipe Threads (Inch).
    b. ANSI/ASME B31.1 - Power Piping.

4. American Water Works Association (AWWA):

    a. AWWA C206 - Field Welding of Steel Water Pipe.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Furnish complete shop drawings for all equipment specified in the various sections, together with all piping, valves and controls for review by the ENGINEER.

2. Include calculations showing equipment anchorage forces and the capacities of the anchorage elements where required.

C. Special Tools:

1. Supply one complete set of special tools where necessary for the assembly, adjustment and dismantling of the equipment.

2. Tools shall be suitable for professional work and manufactured by a recognized supplier of professional tools such as Snap On, Crescent, Stanley, or equal.

D. Spare Parts:

1. Obtain and submit from the manufacturer a list of suggested spare parts for each piece of equipment.

2. Furnish the name, address and telephone number of the nearest distributor for each piece of equipment.

3. Spare parts shall be supplied when indicated in the appropriate equipment specification sections.

E. Torsional and Lateral Vibration Analysis:

1. Where required by the individual equipment sections, provide a torsional and lateral vibration analysis of the equipment, in accordance with Section 01 33 00, Submittals.

2. Equipment shall be designed and constructed such that the natural frequency of the drive train is avoided by a minimum of 25 percent throughout the entire operating range.

3. Analysis shall be performed by a specialist experienced in this type of work and approved by the Engineer.

    a. The specialist, or their assigned representative who shall similarly be experienced in this type of work and who shall be approved by the Engineer, shall visit the Site during

startup and testing of the equipment to analyze and measure the amount of equipment vibration, certify that the operating frequency avoids the natural frequency by 25 percent, and make a written recommendation for keeping the vibration at a safe limit.

1.4 QUALITY ASSURANCE

A. Demonstrate all equipment meets the specified performance requirements. Provide the services of an experienced, competent and authorized service representative of the manufacturer of each item of major equipment, who shall visit the Site to perform the following tasks:

1. Assist the Contractor in the installation of the equipment.

2. Inspect, check, adjust if necessary and approve the equipment installation.

3. Start-up and field-test the equipment for proper operation, efficiency and capacity.

4. Perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the ENGINEER.

5. Instruct the OWNER's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.

B. The costs of all inspection, startup, testing, adjustment and instruction work performed by said factory-trained representatives shall be borne by the Contractor. When available, the Owner's operating personnel will provide assistance in the field testing.

C. Tolerances and clearances shall be as shown on the shop drawings and shall be closely adhered to. Machine work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts.

D. The type of finish shall be the most suitable for the application and shall be in accordance with ANSI B46.1.

E. Unless otherwise noted, all equipment furnished shall have a record from the same manufacturer of at least 3 years successful, trouble-free operation in similar applications.

1.5 DELIVERY, HANDLING AND STORAGE

A. All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling and storage.

B. Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number shown or specified for the particular item.

C. All equipment shall be protected from exposure to corrosion and shall be kept thoroughly dry at all times.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Hearing Protection:

1. At each high noise level location, where equipment produces noise exceeding 85 dBA at 3 feet or exceeding OSHA noise level requirements for operator safety, supply two pairs of high attenuation hearing protectors.

2. Ear protectors shall meet the requirements of ANSI S12.6 and shall produce a noise level reduction of 25 dBA at a frequency of 500 Hz.

3. Hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband.

4. Protectors shall be stored in a weatherproof, labeled, steel cabinet, furnished by the CONTRACTOR and mounted in an approved location near the noise producing equipment.

B. Welding:

1. Unless otherwise specified or shown, all welding shall be by the metal arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS.

2. Qualification of welders shall be in accordance with the AWS Standards governing same.

C. Protective Coatings:

1. All equipment shall be painted or coated in accordance with Section 09 90 00, Painting and Coating, unless otherwise indicated.

2. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil.

3. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly and shipping.

D. All equipment subject to vibration shall be provided with restrained spring type vibration isolators or pads per manufacturer's written recommendations.

E. Shop fabrication shall be performed in accordance with the Specifications and the Engineer-approved shop drawings.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. All equipment supports, anchors and restraint shall be adequately designed for static, dynamic, wind and seismic loads in accordance with Section 01 61 10.

B. Equipment foundations shall be as per manufacturer's written recommendations.

C. All equipment shall be mounted as shown on the manufacturer's standard details, unless otherwise shown or specified.

D. All pipe connections to equipment shall be supported, anchored and guided to avoid stresses and loads on equipment flanges and equipment.

2.3 FLANGES AND PIPE THREADS

A. All flanges on equipment and appurtenances provided under this Section shall conform to ANSI B16.1, Class 125 or B16.5, Class 150, unless otherwise shown.

B. All pipe threads shall be in accordance with ANSI/ASME B1.20.1 and with requirements of Section 40 05 13, Common Work Results for Process Piping.

2.4 COUPLINGS

A. Flexible couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float and to cushion shock loads. Where required for vertical shafts, three-piece spacer couplings or universal type couplings for extended shafts shall be installed.

B. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

C. Taper-lock bushings may be used to provide for easy installation and removal on shafts of various diameters.

D. Where universal type couplings are shown, they shall be equipped with grease fittings.

2.5 BEARINGS

A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association (AFBMA).

B. All field-lubricated type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

C. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer's recommended grease to insure maximum bearing life and best performance.

D. Except where otherwise specified or shown, all bearings shall have a minimum B-10 life expectancy of 5 years or 20,000 hours, whichever occurs first.

E. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as specified or shown, or as recommended in the published standards of the manufacturer. Split type housings may be used to facilitate installation, inspection and disassembly.

F. Sleeve type bearings shall have a Babbitt or bronze liner.

2.6 V-BELT DRIVES

A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA and RMA standards.

B. Unless otherwise specified, sheaves shall be machined from the finest quality gray cast iron.

C. All sheaves shall be statically balanced. In applications where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 fpm may be required to be of special materials and construction.

D. To facilitate installation and disassembly, sheaves shall be furnished complete with taper-lock or QD bushings as required.

E. Finish bored sheaves shall be furnished complete with keyseat and set screws.

F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.7 DRIVE GUARDS

A. All power transmission, prime movers, machines, shaft extensions and moving machine parts shall be guarded to conform with the OSHA Safety and Health Standards (29CFR1910) requirements.

B. Guards shall be constructed of minimum 10-gauge expanded, flattened steel with smooth edges and corners, galvanized after fabrication and securely fastened.

C. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.

2.8 FLEXIBLE CONNECTORS

A. Flexible connectors shall be installed in all piping connections to engines, blowers, compressors and other vibrating equipment.

2.9 GASKETS AND PACKINGS

A. Gaskets shall be in accordance with the requirements of Section 40 05 13, Common Work Results for Process Piping.

B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron type “V” packing shall be Garlock No. 432, John Crane “Everseal” or equal.

C. Packing around rotating shafts (other than valve stems) shall be “O” rings, stuffing boxes or mechanical seals, as recommended by the manufacturer and approved by the ENGINEER.

2.10 NAMEPLATES

A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location.

B. Nameplates shall contain the manufacturer’s name, model, serial number, size, characteristics and appropriate data describing the machine performance ratings.

PART 3 EXECUTION

3.1 WELDING

A. In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions.

B. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag and burrs left by attachments shall be removed.

C. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions.

D. All sharp corners of material to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.2 COUPLINGS

A. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

B. Installation shall be per equipment manufacturer's printed recommendations.

3.3 PACKAGED EQUIPMENT

A. When any system is furnished as pre-packaged equipment, the Contractor shall coordinate all necessary space and structural requirements, clearances, utility connections, signals and outputs with his subcontractors.

B. If the packaged system has any additional features other than specified, the Contractor shall coordinate such features and furnish all material and labor necessary for a complete installation, as required by the manufacturer, at no additional cost to the Owner.

END OF SECTION

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SECTION 22 00 00

PLUMBING

PART 1 GENERAL

1.1 SCOPE

A. This section covers the work necessary to furnish materials, labor, equipment and services necessary to provide all plumbing fixtures, equipment, and specialties as shown on the drawings and specified herein.

1.2 RELATED SECTIONS

A. Section 40 05 13 – Common Work Results for Process Piping

B. Section 40 05 51.72 – Process Control Valves

1.3 QUALITY ASSURANCE

Install plumbing to meet requirements of local and state codes and provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

1.4 SUBMITTALS

Submittals shall include manufacturers certificate of conformance; certified copies of test reports; documentation on plumbing fixtures; layout showing type, spacing, maximum loads and materials for hangers and supports and manufacturer's warranty statements.

PART 2 PRODUCTS

2.1 PLUMBING SPECIALTIES

A. Floor Drains (Standard)

1. Floor drains shall be of cast iron with sediment buckets. Floor drains shall be sized to match the outlet piping as shown on the plans.

2. All floor drains will have a connection for a 3/8-inch copper line from the trap primer.

3. Floor drains shall be model JR Smith 2490, or approved equal.

B. Cleanouts

1. All cleanouts shall be heavy plugs with tapered shoulders against caulked lead or heavy brass plugs. Where underground or concealed, cleanouts shall be brought to floor level and to accessible locations with access covers and frames.

2. Manufacturer's, or Equal: The following cleanouts, or equal, shall be furnished:

	Josam	J.R.Smith	Zurn
Exposed locations	58500-20	4405	Z-1440-A
Underground	53010-30	4143	ZN-1400-2
Walls, concealed	58790-20	4535	ZN-1445-1-A
Traffic areas	56070	4240	Z-1420-27

C. Reduced-Pressure Backflow Preventer

Reduced-pressure assemblies ¾-inch through 2-inch shall consist of a differential pressure relief valve located between two independently acting "Y" pattern check valves, two full ported ball valve shut-offs and four test cocks. Mainline valve body and caps, including relief valve body and cover, shall be bronze. Check valves shall be center stem guided. All seat discs shall be reversible. The relief valve shall have a removable seat ring. Assemblies shall be certified in compliance with ASSE 1013, AWWA C511-89, and CAN/CSA B64.4, and approved by the Oregon State Department of Health. The reduced-pressure assembly shall be Febco Model 825Y or approved equal.

D. Hose Bibbs

1. General: All hose bibbs in exposed locations subject to freezing shall be of the non-freeze type. Where hose bibbs are connected to a non-potable water supply, they shall be provided with plastic or stainless steel warning signs "DO NOT DRINK," in clearly legible letters and permanently attached at the hose bibb. Where shown, hose bibbs shall be provided with vacuum breakers as furnished by Crane Co.; American Standard; or equal.

2. Manufacturers, or Equal

   a. Non-Freeze Post-Type: Exposed bronze hydrant, post-type, depth of bury to suit local conditions, minimum 3 feet.

      1) Josam Mfg. Co., Series 71700
      2) J. R. Smith Mfg. Co., Series 5910
      3) Zurn Industries, Inc., Fig. Z-1385 or 1390
      4) Or approved equal.

   b. Non-Freeze Wall-Type: Heavy-duty bronze hydrant with nickel-bronze face, stainless steel hinged cover, stainless steel recessed box and key. Length to suit wall. Zurn Industries, Inc., Fig. Z-1300-SS, or approved equal.

E. Pressure-Reducing and Relief Valves

1. Pressure-reducing and relief valves shall be of the spring-loaded diaphragm type with a minimum pressure rating of 250 psi, bronze body, nickel alloy or stainless steel seat and threaded ends. These valves are limited to use in interior plumbing systems.

2. Manufacturers, or Equal

   a. A.W. Cash Valve Mfg. Corp
   b. Fisher Controls Company
   c. Mueller Company
   d. Masoneilan
   e. Watts Regulator Company
   f. Wilkins Regulator

F. Air Gap

1. Watts Model 909-AG-A, or Equal

G. Ball Valves, 2 Inches and Under

1. As specified in Section 40 05 51.72, Process Control Valves.

H. Strainers (Metal Body)

1. Equipment Requirements: Strainers shall be of the Y-pattern or basket type with flush connections, bronze bodies and screwed ends for sizes 3-inch and smaller; and cast iron with flanged ends for sizes greater than 3-inch.

   a. Strainers shall be designed for not less than 250 psi working pressure in sizes 3-inch and smaller, and 125 psi working pressure in sizes over 3-inch.

   b. Strainers shall be of the same size as the entering pipe and the screens shall have a free area of not less than three times the cross-sectional area of the pipe.

2. Screens: Unless otherwise indicated or required by the service fluid, the screen shall be of Type 316 stainless steel or monel construction, easily removable, with the following mesh or perforations:

Strainer Size	Size of Perforations
1/4- through 2-inch	20 mesh
2 1/2- through 5-inch	20 mesh
6- through 8-inch	1/8-inch diameter
over 8-inch	3/16-inch diameter

3. Strainers shall be Spriax-Sarco, Type BT and IF-125, or equal

I. Pressure Gauges

1. Refer to specification section 40 91 09 Pressure Detection Devices for specifications related to pressure gauges.

2.2 INSULATION

A. All hot and cold water piping valves and fittings and vent piping shall be provided with one-inch thick insulation.

B. All components of the insulation, including covering, mastics and adhesives shall have a flame spread rating of not over 25, and a smoke development rating of not over 50. Ratings shall be as established by tests in accordance with ASTM E 84 and Federal Specification standards. Insulation shall be applied in strict accordance with the manufacturer's instructions.

C. Pipe insulation shall be molded-type pipe covering made of fibrous glass with a minimum K-factor of 0.23 at 75°F mean temperature.

D. Insulation shall have a factory-applied white fire-retardant vapor-barrier jacket of Kraft paper and aluminum foil laminated together and reinforced with fiberglass yarn. Fittings and valves shall be covered with the same material as the pipe, cut in segments to fit snugly without open spaces, held in place with copper wire or cement, and then covered with the same jacketing material as the pipe. Insulated fittings adjacent to vapor-barrier insulation shall be sealed with an acceptable vapor-barrier cement before installation of the finish jacket. Pipe insulation and vapor-barrier shall be continuous through hangers and supports. Where insulation protection shields are provided, the top half section of pipe insulation at support locations shall be of the same specified density; and the bottom half insulation segments provided between the pipe and the insulation protection shields shall have a density of not less than 6 lb./cu. ft. All insulation shall be covered with smooth aluminum weatherproof metal or plastic performed jacketing with a factory-attached moisture barrier. The jacket for the fittings shall consist of precision-formed smooth-sided sections and shall be sized to cover and protect the insulated fitting. Each section shall be manufactured from aluminum or PVC and all joints shall be sealed with silicon mastic or solvent welding to provide a continuous, air and weathertight joint. Strapping shall be 1/2-inch wide Type 3003 aluminum or stainless steel.

E. Manufacturers, or Equal

1. Armstrong Contracting and Supply Corporation
2. Certain-Teed Corporation
3. Manville

4. Owens-Corning Fiberglass Corporation
5. PPG Industries, Inc.

2.3 PEX (CROSS-LINKED POLYETHYLENE)

A. Standards

1. ASTM; F876, F877, F2023, F2657, F2788, F2829, F2929, F3253

2. AWWA C904

3. CSA B137.5

B. Manufacturers, or Equal

1. Zurn PEX
2. Watts
3. IPEX
4. Golan

PART 3 EXECUTION

3.1 FIXTURE INSTALLATION

A. Each fixture shall be installed with trap, easily removable for servicing and cleaning, and vented in accordance with the applicable plumbing code.

B. The CONTRACTOR shall provide chrome-plated rigid or flexible supplies to fixtures with angle stops, reducers and escutcheons.

C. All fixtures shall be installed and secured in place with wall supports, wall carriers, floor carriers and bolts.

D. Fixtures shall be sealed to wall and floor surfaces with sealant as indicated in Section 07 92 00, Joint Sealants. Color shall match fixture.

3.2 PLUMBING SPECIALTIES INSTALLATION AND APPLICATION

A. The CONTRACTOR shall coordinate the work of roughing-in, wall and floor sleeves, pipe inserts, cutting of roof and floor construction to receive drains to required invert elevations. Pipes below ceilings shall be held as high as possible without interfering with other trades.

B. The CONTRACTOR shall install all plumbing specialties in accordance with manufacturer's printed instructions to permit intended performance.

C. Cleanouts shall be extended to finished floor or wall surface. Threaded cleanout plug shall be lubricated with mixture of graphite and linseed oil. The CONTRACTOR shall ensure sufficient clearance at cleanouts for rodding of drainage system.

D. Exterior cleanouts shall be encased in concrete flush with pavement or they shall be extended to above finished grade in unpaved locations.

3.3 PIPING INSULATION INSTALLATION

Piping insulation shall be installed in strict conformance with the manufacturer's recommendations.

END OF SECTION

SECTION 22 11 19 – YARD HYDRANTS

PART 1 GENERAL

1.1 Description

The CONTRACTOR shall furnish and install yard hydrants and all appurtenant work, complete and operable as shown on the plans and in accordance with the requirements of the Contract Documents. The yard hydrant shall be complete with mounting hardware and fittings.

1.2 Related Sections – NOT USED

1.3 References

A. SWDA Section 1417(d)

1.4 Submittals

A. Shop drawings, product technical data and material data.
B. Applicable material certificates and testing certificates.

1.5 Delivery, Storage and Handling

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions. Do not store materials in direct sunlight.
C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 Manufacturer

A. Zurn Industries, LLC. or equal.

2.2 Material

A. Exposed, lead-free, non-freeze Yard Hydrant. Hydrant features a Dura-Coated cast iron head and lift handle with lock option, galvanized steel casing, bronze and

stainless steel interior components, ¾" inlet connection with 1/8" tapped drainage port on housing, and ¾" male hose connection.

a. Hydrant Head – cast iron
b. Operating Rod – stainless steel
c. Interior Components – low-head bronze and stainless steel
d. Plunger Assembly – NBR
e. Hydrant Casing – galvanized steel
f. Valve Housing – low-lead bronze
g. ¾" Hose Adapter – low-lead bronze
h. Packing – fiber graphite

B. Sizing (Depth of Bury) Feet

a. 2'
b. 3'
c. 4'
d. 5'
e. 6'
f. 8'

PART 3 EXECUTION

3.1 Installation

Yard Hydrant -- All appurtenant work shall be installed in strict accordance with the manufacturer's printed instructions and as shown or in the manner deemed acceptable by the ENGINEER.

3.2 Protection

Protect installed Yard Hydrant from damage prior to, during, and post construction.

END OF SECTION

SECTION 22 14 19 - SUBMERSIBLE SUMP PUMPS

PART 1 GENERAL

1.1 Description

The CONTRACTOR shall furnish and install submersible sump pumps and all appurtenant work, complete and operable as shown on the plans and in accordance with the requirements of the Contract Documents. The pumps shall be complete with mounting hardware and fittings.

1.2 Submittals

A. Shop drawings, product technical data and material data.
B. Applicable material certificates and testing certificates.
C. Manufacturer's handling, delivery, storage and installation requirements.
D. Operation and maintenance manual

PART 2 PRODUCTS

2.1 Motor – Submersible motor to be constructed with open winding and to operate in clean dielectric oil for cooling winding and lubricating motor bearings. Motor shaft to be sealed with mechanical shaft seal, having super lapped seal rings of carbon and ceramic. Integral motor and pump shaft to be stainless steel. Motor to be 2 HP and operate at not more than 3,450 RPM. Unit to operate on 230 volt, single phase, 60 Hz and shall be equipped with a 20-foot long power cord. Motor shall have thermal overload with automatic reset.

2.2 Pump – Pump shall have a capacity of at least 170 gallons per minute at 35 feet TDH. Pump discharge shall be 3-inch diameter.

2.3 Material -- Pump and motor housing to be of cast iron. Impeller shall be ductile iron and of the non-clog type. No suction strainers or screens of any type to be used.

2.4 Automatic Control – The unit shall be equipped with a diaphragm type pressure switch.

2.5 Submersible sump pumps shall be Model S3W200M2-2 as manufactured by Hydromatic Pumps or approved equal.

PART 3 EXECUTION

3.1 Installation

Submersible Pumps -- All appurtenant work shall be installed in strict accordance with the manufacturer's printed instructions and as shown.

END OF SECTION

SECTION 23 81 40 - HEAT PUMPS

PART 1 GENERAL

1.1 DESCRIPTION

A. Split systems shall be factory assembled, single package, designed for indoor/outdoor installation. The units shall be factory wired, piped, and charged with R-410A refrigerant and factory tested prior to shipment. All unit wiring shall be both numbered and color coded. The cooling performance shall be rated in accordance with DOE and AHRI test procedures. Units shall be CSA certified to UL 1995 standards.

1.2 REFERENCES

A. The following is a list of standards governing the products in this Section:

1. ASHRAE 90.1
2. UL 60335-2-40

1.3 SUBMITTALS

A. Action Submittals: Provide for all products specified, as follows:

1. Unit tag number or equipment identification as referenced in Contract Documents.
2. Manufacturer’s name and model number.
3. Descriptive specifications, literature, and drawings.
4. Dimensions and weights.
5. Capacities and ratings.
6. Thermostat – wireless remote control
7. Construction materials.
8. Motor and Power Data.
9. Manufacturer's standard vibration isolation accessories.
10. Factory finish system.
11. Insulated line set, and line set protection system.

B. Informational Submittals:

1. Recommended procedures for protection and handling of products prior to installation.

2. Manufacturer’s installation instructions, including seismic anchorage and bracing requirements.

3. Factory test reports.

4. Operation and Maintenance Data.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENT

A. Cooling : As shown on drawings.
B. Heating: As shown on drawings.

2.2 INDOOR UNIT

A. The indoor units shall be installed in accordance with the manufacturer's requirements.

2.3 OUTDOOR CONDENSER FAN ASSEMBLY

A. The outdoor fans shall be of the direct drive type, have aluminum blades riveted to corrosion resistant steel spider brackets and shall be dynamically balanced for smooth operation. The outdoor fan motors shall have permanently lubricated bearings internally protected against overload conditions and staged independently. A cleaning window shall be provided on two sides of the units for coil cleaning.

2.4 REFRIGERANT COMPONENTS

A. Compressors:

1. Shall be fully hermetic type, direct drive, internally protected with internal high-pressure relief and over temperature protection. The hermetic motor shall be suction gas cooled and have a voltage range of plus or minus 10 percent of the unit nameplate voltage. Compressor shall be variable speed inverter-driven.

2. Shall have internal spring isolation and sound muffling to minimize vibration and noise, and be externally isolated on a dedicated, independent mounting.`

B. Coils:

1. Evaporator coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed. Special Phenolic coating shall be available as a factory option.

2. Evaporator coils shall be of the direct expansion, draw-thru design.

3. Condenser coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed or Micro-Channel aluminum tube, aluminum fins. Special Phenolic coating shall be available as a factory option.

4. Condenser coils shall be of the draw-thru design.

C. Refrigerant Circuit and Refrigerant Safety Components shall include:

1. Independent fixed-orifice or thermally operated expansion devices.

2. Solid core filter drier/strainer to eliminate any moisture or foreign matter.

3. Accessible service gauge connections on both suction and discharge lines to charge, evacuate, and measure refrigerant pressure during any necessary servicing or troubleshooting, without losing charge.

4. The unit shall have two independent refrigerant circuits, equally split in 50 percent capacity increments.

D. Unit Controls:

1. Unit shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side.

2. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit should any of the following standard safety devices trip and shut off compressor:

   a. Loss-of-charge/Low-pressure switch
   b. High-pressure switch

3. Freeze condition sensor on evaporator coil. If any of these safety devices trip, the LCD screen will display the alarm message.

4. Unit shall incorporate "AUTO RESET" compressor over temperature, over current protection.

5. Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up.

6. Unit control board shall have on-board diagnostics and fault message display.

7. Standard controls shall include anti-short cycle and low voltage protection, and permit cooling operation down to a selectable value as low as 0 degrees Fahrenheit (F).

8. Control board must monitor each refrigerant safety switch independently.

2.5 UNIT OPERATING CHARACTERISTICS

A. Unit shall be capable of starting and running at 125 degrees F outdoor temperature, exceeding maximum load criteria of AHRI Standard 340/360. The compressor, with standard controls, shall be capable of operating down to 0 degrees F outdoor temperature.

2.6 ELECTRICAL REQUIREMENTS

A. All unit power wiring shall enter unit cabinet at a single factory provided location and be capable of side or bottom entry to minimize penetrations and avoid unit field modifications. Separate side and bottom openings shall be provided for the control wiring.

2.7 LINE SETS

A. All units must be installed with Insulated copper line sets. Provide line set covers for all exterior piping.

2.8 WARRANTIES

A. Compressor – 7 Years, Parts – 5 Years.

2.9 ACCESSORIES

A. Equipment Identification Plates: Furnish 16-gauge Type 316 stainless steel identification plate securely mounted on each separate equipment component in a readily visible location. Plate shall bear 3/8-inch high engraved or die-stamped block type equipment identification number and letters indicated in this Specification and as shown on DRAWINGS. All units shall include factory installed permanently attached nameplate displaying unit model and serial number.

2.10 MANUFACTURERS AND PRODUCTS:

A. MrCool;
B. Fujitsu;
C. Approved Equal

PART 3 EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Indoor unit condensation drain line must be routed with a constant downward slope to an approved disposal point inside to a drain or outside the building. If this is not possible given the location, a condensate pump must be provided to dispose of condensate.

C. Labeling: Label units in accordance with Article Accessories.

D. Service Access: Locate units to provide access spaces required for motor, drive, bearing servicing, and fan shaft removal.

E. Connections:

1. Per manufacturers requirements.

3.2 FIELD QUALITY CONTROL

A. Functional Tests:

1. Verify blocking and bracing used during shipping are removed.

2. Verify fan is secure on mountings and supporting devices, and connections to ducts and electrical components are complete.

3. Verify proper thermal-overload protection is installed in motors, starters, and disconnect switches.

4. Verify that cleaning and adjusting are complete.

5. Verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.

6. Verify lubrication for bearings and other moving parts.

7. Verify manual and automatic volume control and dampers in connected ductwork are in fully open position.

B. Performance Tests:

1. Starting Procedures:

a. Energize motor and adjust fan to indicated revolutions per minute.
b. Measure and record motor voltage and amperage.

2. Operational Test:

a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

b. Repair or replace malfunctioning units; retest as specified after repairs or replacement is made.

c. Test and adjust control safety.

d. Replace damaged and malfunctioning controls and equipment.

3.3 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

B. On completion of installation, internally clean fans according to manufacturers' written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

END OF SECTION

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TECHNICAL SPECIFICATIONS – DIV 26 through DIV 43

PUMP STATION REHABILITATION AND UPGRADES PROJECT

GROUP 3 – SOUTH WELCHES, GOLF CLUB TERRACE, 82ND DRIVE AND SIEBEN LANE PUMP STATIONS

FOR

Clackamas Water Environment Services

Volume 2 of 3

MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

Water Environment Services
150 Beavercreek Rd, Suite 430
Oregon City, OR 97045

PROFESSIONAL OF RECORD CERTIFICATION(S):

 RENEWS 12/31/2025	Signing as the Professional of Record for the divisions and sections listed below: Divisions 11, 23

PROFESSIONAL OF RECORD CERTIFICATION(S):



Signing as the Professional of Record for the divisions and sections listed below:

Sections:
01 41 20; 03 21 00; 03 30 00; 03 60 00; 04 05 17; 04 22 00; 05 12 00; 05 12 13; 05 31 23; 05 40 00; 05 50 00; 06 05 23; 06 10 00; 06 17 53

PROFESSIONAL OF RECORD CERTIFICATION(S):

 **Expires: May 31, 2025**	Signing as the Professional of Record for the divisions and sections listed below: Sections 32 91 13, 32 92 00, 32 93 00

PROFESSIONAL OF RECORD CERTIFICATION(S):

	Signing as the Professional of Record for the divisions and sections listed below: Divisions 02, 10, 22, 31, 33, 43 Sections 01 10 00, 01 12 16, 01 22 20, 01 32 00, 01 33 00, 01 45 00, 01 56 39, 01 57 19.11, 01 60 00, 01 75 16, 03 01 30.71.11, 09 90 00, 32 11 23, 32 12 16, 32 31 13, 40 05 13, 40 05 23.72, 40 05 51, 40 05 51.24, 40 05 61, 40 05 62

PROFESSIONAL OF RECORD CERTIFICATION(S):

	Signing as the Professional of Record for the divisions and sections listed below: Division 07 Sections 07 21 00, 07 25 00, 07 30 12, 07 41 13, 07 42 13, 07 62 00, 07 92 00 Division 08 Sections 08 11 13, 08 71 00 Division 09 Sections 09 91 13, 09 91 23

PROFESSIONAL OF RECORD CERTIFICATION(S):

 EXPIRES: June 30, 2026	Signing as the Professional of Record for the divisions and sections listed below: Divisions 40 Sections 40 91 00, 40 91 07, 40 91 08, 40 91 09, 40 91 12, 40 91 14, 40 91 23, 40 92 00, 40 93 00, 40 95 11

PROFESSIONAL OF RECORD CERTIFICATION(S):

 EXPIRES: 6/30/26	Signing as the Professional of Record for the divisions and sections listed below: Divisions 26

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GROUP 3 – SOUTH WELCHES, GOLF CLUB TERRACE, 82ND DRIVE & SIEBEN LANE PUMP STATIONS
FOR
CLACKAMAS WES

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END OF SECTION

SECTION 26 05 00 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies general requirements applicable to all electrical work to be completed at the facility. This may include such things as underground conduit, surface conduit, motors, control components and similar.

B. Section includes:

1. Scope.
2. Definitions.
3. Reference Standards.
4. Quality Assurance.
5. Submittals.
6. Drawings.
7. Project Site Conditions.
8. Equipment Coordination.
9. Basis of Design.
10. Products.
11. Execution – General.
12. Testing.

1.2 SCOPE

A. This section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this section.

B. Related Sections:

1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

C. Interfaces to Equipment, Instruments, and Other Components:

1. The Drawings, Specifications, and overall design are based on preliminary information furnished by various equipment manufacturers, which identify a minimum scope of supply from the manufacturers. This information pertains to, but is not limited to, instruments, control devices, electrical equipment, packaged mechanical systems, and control equipment provided with mechanical systems.

2. Provide all material and labor needed to install the actual equipment furnished. Include additional conduit, wiring, terminals, or other electrical hardware to the work, which may

be necessary to make a complete functional installation, based on the actual equipment furnished:

a. Make all changes necessary to meet the manufacturer's wiring requirements.

3. Submit all such changes and additions to the Engineer for acceptance in accordance with the General Conditions.

4. Review the complete set of Drawings and Specifications in order to ensure that all items related to the electrical power and control systems are completely accounted for. Include items that appear on Drawings or in Specifications from another discipline in the scope of Work:

a. If a conflict between Drawings and Specifications is discovered, refer conflict to the Engineer as soon as possible for resolution.

D. All electrical equipment and systems for the entire project shall comply with the requirements of Division 26, whether referenced in the individual equipment specifications or not:

1. The requirements of Division 26 apply to all electrical work specified in other Divisions and Sections, including HVAC controls, packaged mechanical systems, Local Control Panels (LCPs), Vendor Control Panels (VCPs), Instruments Junction Boxes (IJBs), Power Junction Boxes (PJBs) and enclosures.

2. The OWNER is not responsible for any additional costs due to the failure of the CONTRACTOR to notify all Subcontractors and suppliers of the Division 26 requirements.

E. Contract Documents:

1. General:

a. The Drawings and Specifications are complementary and are to be used together to fully describe the Work.

2. Contract Drawings:

a. The electrical Drawings show in a diagrammatic manner, the desired locations, and arrangements of the components of the electrical work. Follow the Drawings as closely as possible. Use professional judgment and coordinate with the other trades to secure the best possible installation. Use the entire Drawing set for construction purposes.

b. Locations of equipment, control devices, instruments, boxes, and panels are approximate only, exercise professional judgment in executing the Work to ensure the best possible installation:

1) The equipment locations and dimensions shown on plans and elevations are approximate. Use the Shop Drawings to determine the proper layout, foundation, and pad requirements for final installation. Coordinate with all Subcontractors to ensure that all electrical equipment is compatible with other equipment and space requirements. Make changes required to accommodate differences in equipment dimensions.

2) The CONTRACTOR has the freedom to select any of the named manufacturers, as identified in the individual specification sections. The Engineer has designed the spatial equipment layout based upon a single manufacturer and has not confirmed that every named manufacturer's equipment fits in the allotted space. It is the CONTRACTOR's responsibility to ensure that the equipment being furnished fits within the defined space.

c. Installation Details:

The Contract Drawings include typical installation details, which show the means and methods the CONTRACTOR is to use to install electrical equipment. For cases where a typical detail does not apply, develop installation details that may be necessary for completing the Work, and submit these details for review by the Engineer.

1.3 DEFINITIONS

A. WIRING, ELEMENTARY OR SCHEMATIC DIAGRAM: A schematic (elementary) diagram shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.

B. ONE-LINE DIAGRAM: A one-line diagram shows by means of single lines and graphical symbols the course of an electrical circuit or system of circuits and the components, devices or parts used therein. Physical relationships are usually disregarded.

C. BLOCK DIAGRAM: A block diagram is a diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.

D. CONNECTION DIAGRAM: A connection diagram includes all of the devices in a system and shows their physical relationship to each other including terminals and interconnecting wiring in an assembly. This diagram shall be (a) in a form showing interconnecting wiring only by terminal designation (wireless diagram), or (b) a panel layout diagram showing the physical location of devices plus the elementary diagram.

E. INTERCONNECTION DIAGRAM:

1. Interconnection diagrams shall show all external connections between terminals of equipment and outside points, such as motors and auxiliary devices. References shall be shown to all connection diagrams which interface to the interconnection diagrams. Interconnection diagrams shall be of the continuous line type. Bundled wires shall be shown as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable.

2. Each wire identification as actually installed shall be shown. The wire identification for each end of the same wire shall be identical. All devices and equipment shall be identified. Terminal blocks shall be shown as actually installed and identified in the equipment complete with individual terminal identification.

3. All jumpers, shielding and grounding termination details not shown on the equipment connection diagrams shall be shown on the interconnection diagrams. Wires or jumpers shown on the equipment connection diagrams shall not be shown again on the

interconnection diagram. Signal and DC circuit polarities and wire pairs shall be shown. Spare wires and cables shall be shown.

F. ARRANGEMENT, LAYOUT, and/or OUTLINE DRAWINGS: An arrangement, layout, and or outline drawing is one which shows the physical space and mounting requirements of a piece of equipment. It may also indicate ventilation requirements and space provided for connections or the location to which connections are to be made.

1.4 REFERENCE STANDARDS

A. 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.

B. 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 other- wise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
NECA-1	National Electrical Contractors Association – Standard Practices for Good Workmanship in Electrical Contracting
NFPA-70 NFPA-70E	National Electrical Code (NEC) Electrical Safety in the Workplace
NEMA	National Electrical Manufacturers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IBC	International Building Code
OAR	Oregon Administration Rules

1.5 QUALITY ASSURANCE

A. IDENTIFICATION OF LISTED PRODUCTS:

1. Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. Three such organizations are Underwriters Laboratories (UL), Factory Mutual (FM), 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. CONTRACTOR shall comply with Oregon Administrative Rules regulations concerning Listing requirements for electrical equipment.

B. FACTORY TESTS: Where specified in the individual product specification section, factory tests shall be performed at the place of fabrication and performed on completion of manufacture or assembly. The costs of factory tests shall be included in the contract price.

C. DELIVERY AND STORAGE:

1. CONTRACTOR shall receive, handle and store products according to manufacturer's written instructions or recommendations.

2. Keep all products to be kept warm, dry, safe and secure in original packaging until ready for installation.

3. CONTRACTOR shall be responsible for all equipment to be delivered, free of damage and in as-intended working condition. Any items determined to be defective or damaged shall be replaced at no additional expense to the OWNER.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

   a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

   b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

   b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

   c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the submitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or

materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

4. Provide Seismic calculations for anchoring and support of equipment as required in 01 61 10.

5. Interconnection diagram: The CONTRACTOR shall prepare interconnection diagrams depicting all cable requirements together with their actual terminations as specified.

6. Conduit layout drawings indicating size, location, and support, for all conduits other than single runs of 1-inch diameter or less cast in concrete construction.

a. Conduit layout drawings shall illustrate a system which conforms to the requirements of the project.

b. For changes to the layouts shown on the contract documents, provide engineering design and calculations signed and sealed by a Professional Engineer registered in State of Oregon. Engineering design and calculations shall demonstrate that the proposed layout does not impair or significantly reduce the design structural strength.

7. Safety disconnect switch list including legend with equipment tag, equipment description, and power feeder circuit source and location information.

8. Roof Penetrations: Submit details of all portions of the electrical installation that penetrate the roof. Include details showing support of the penetrating component, and the sealing means to be utilized.

1.7 DRAWINGS

A. Where the CONTRACTOR is required to provide information on drawings as part of the specified work, such drawings shall be prepared on 11-inch by 17-inch paper, and on CD Rom in AutoCAD 2020. Drawings shall be complete with borders and title blocks clearly identifying project name, equipment and the scope of the drawing. Drawing quality and size of presentation shall be such as to permit 50 percent reduction of such drawings for insertion in operation and maintenance manuals. Drawings deemed illegible shall be rejected.

B. Where the CONTRACTOR is required to provide equipment or system submittal information on drawings as part of the specified work, such drawings shall be prepared on 11-inch by 17-inch paper and shall be included within a three-ring binder. Drawings shall be complete with borders and title blocks clearly identifying project name, equipment and the scope of the drawing. Drawing quality and size of presentation shall be such as to permit 50 percent reduction of such drawings for insertion in operation and maintenance manuals. Drawings deemed illegible shall be rejected.

1.8 PROJECT/SITE CONDITIONS

A. GENERAL: Unless otherwise specified, equipment and materials shall be sized and derated for the ambient condition of 40 degrees C at an elevation ranging from sea level to 3000 feet without exceeding the manufacturer's stated tolerances.

B. OPERATING FACIILITY: When working in an operating facility, such as a pump station or treatment plant, portions of this facility must remain fully functional throughout the entire construction period. In consideration of this requirement, comply with the following guidelines:

1. All outages must be of minimal duration and fully coordinated and agreed to by the OWNER. Adjust the construction schedule to meet the requirements of the OWNER. All changes in schedule and any needs to reschedule are included in the Work.

2. As weather and operational conditions dictate, re-adjust the construction schedule to meet the demands placed upon OWNER by its users.

3. Coordinate the construction and power renovation, bear all costs, so that all existing facilities can continue operation throughout construction.

C. HAZARDOUS (CLASSIFIED) AREAS: Areas designated as hazardous (classified) are identified within drawings in accordance with the NEC, NFPA 820.

D. SEISMIC: Electrical equipment supports, and anchorage shall be designed and in- stalled in accordance to 01 61 10.

1.9 ELECTRICAL NUMBERING SYSTEMS

A. TAGGING: All circuit raceways and armored cables shall be tagged at all terminations, panels, MCCs, pull boxes, junction boxes, etc. in accordance with the assigned numbers on the circuit/raceway schedule and schematic/plan drawings. The tags shall be installed in a clean and high workmanship manner. In addition to tags at the terminations, exposed raceways and armored cables shall be tagged at each side of concealment.

1. The standards of documentation, instrument tagging, cable and conductor ferruling, terminal identification and labeling that apply to the new installation apply equally to the existing installation which forms part of the modified system.

B. PREFIX MODIFIERS: The following prefix modifiers shall be used when scheduling/tagging cables and raceway:

Raceway Prefix	Type of Function
H	Power above 600V
P	Power 120V to 600V
C	Control or power - 120V or less
S	Low level signal (less than 90-volt communication or less than 30-volt instrumentation)
D	Data
PC	Composite of power 120 to 600V and control
F	Optical Fiber
PSP, CSP	Spare power, spare control

C. RACEWAY NUMBERS: Where circuit/raceway numbers have not been assigned, CONTRACTOR shall assign raceway numbers in accordance with the system outlined in the drawings.

1.10 CONDUCTOR NUMBERS:

A. WIRE MARKERS: All control and signal conductors in panels, pull boxes, power, instrument, and relay compartments of motor control centers, control cabinets, instrument cabinets, field cabinets and control stations, as well as connections to mechanical equipment, shall be tagged at each end with legible, coded tight-fitting wire-marking sleeve showing the complete wire designation. The letters and numbers that identify each wire shall be machine printed on sleeves with permanent black ink. The figures shall be 1/8 inch high. Sleeves shall be yellow or white tubing, sized to fit the conductor insulation. The sleeves shall be shrunk to fit the conductor with hot air after installation. They shall be T&B, SHRINK-KON HVM or equal. Adhesive strips are not acceptable. Conductors size No. 10 AWG or smaller shall have identification sleeves. Conductors No. 8 AWG and larger shall use cable markers of the locking tab type. Tabs shall be white plastic with conductor identification number permanently embossed.

B. INTERNAL WIRING:

1. Wiring within a single enclosure shall be marked with the basic wire and terminal number at each end. The wire number shall designate the terminal or equipment number at each end of the wire separated by a slash.

2. Wiring within MCC buckets shall have a simple numbering scheme, and shall use the same number at each end. (1,2,3,4,5, etc.) Wiring which lands on field terminals shall utilize the terminal number for the internal wire number.

C. FIELD WIRING: All field wiring shall have wire labels at each end. The labels shall be marked with the output terminal number at the original equipment (local control panel or MCC) and the remote device terminal # (if applicable) and tag name separated by a slash. Conductors shall be identified with numbers at both ends. Conductor tag numbers shall be the conductor number specified on the control diagram or if not shown, shall follow the convention below.

1. Wires from MCC buckets shall be labeled with [MCC number (086) - bucket number(A4) - terminal number (6)] (MCC3-A4-6)

2. Wires from Local Control Panels shall be labeled with panel number (PNL2000)- terminal number (12)] (PNL2000-12)

3. Wires from PLC panels or remote I/O panels shall have Rack or Bus (1) – Card or Block (7) - Terminal number(A3) only (1-7-A3)

4. Wires from devices, instruments etc. shall have the instrument or device name and terminal number if applicable. Equipment name is typically DEVICE TYPE - NUMBER. (HS-2510) (TSH-2510) (FIT-2562)

D. EXAMPLE for a control cable from the Area Control Panel PNL2000 bus 1, block 1, terminal A4 to the level transmitter (LIT-2501) - the wire tag number at both ends shall be LIT-2501 / 1-1-A4. (Do not include the panel name, just the bus, block, terminal number.)

E. EXAMPLE for a control cable from the Area Control Panel PNL2000 rack 4, card 5, terminal A4 to the MCC3, bucket D5 terminal 6 the tag number at both ends shall be MCC3-D5-6/4-5-A4

F. EXAMPLE for a control cable from the MCC3 bucket A4 terminal 12 to device HS-4030, the wire tag number at both ends shall be MCC3-A4-12 / HS-4030. (Do not include the system abbreviation on devices connected to an MCC bucket.)

1.11 INDICATING LAMP COLORS

A. All indicating lamps shall have an integrated lamp-test function for all lamps on a single line-up of equipment (i.e. Motor Control Center, Switchgear).

B. Unless otherwise specified, indicating lights shall be equipped with colored lenses in accordance with the following schedule:

Color	Function	Example
Red	Run, open valve	Equipment operating, motor running
Green	Stopped, Closed valve	Alarm, end of cycle, motor stopped
White or clear	Normal condition, Ready	Control power on, status OK
Amber (yellow)	Abnormal condition	Failure of equipment or status abnormal, fault condition
Green	Breaker Open	Switchgear breaker illuminated pushbutton
Red	Breaker Closed	Switchgear breaker illuminated pushbutton
Amber (yellow)	Breaker Tripped	Switchgear breaker illuminated pushbutton

1.12 EQUIPMENT COORDINATION

A. The CONTRACTOR is responsible to coordinate the equipment supplied from various manufacturers and vendors. This includes but is not limited to:

1. Obtaining specific information on equipment ratings and sizes and verifying the electrical components supplied meet, or match the requirements such as voltage, phase, frequency, starter types, etc.

2. Shall provide equipment that will fit within the space allocated and meet OSHA and NEC clearances.

3. Shall provide coordinated electrical installations with the supplied equipment's electrical power and control requirements.

4. Shall provide power and control equipment, wiring, and raceways to meet the requirements of the mechanical equipment supplied.

5. Shall provide all necessary control wiring and components for any special requirements from an equipment manufacturer.

B. The CONTRACTOR shall verify as a minimum:

1. Correct voltage, phase and frequency
2. Size and space requirements
3. Mounting requirements
4. Correct motor starter type and NEMA size
5. Proper coordination with the controls and control System Integrator

C. Any discrepancies between the electrical equipment and other equipment shall be brought to the immediate attention of the OWNER.

D. The CONTRACTOR shall assure that no instrumentation or control interferences are created by the variable frequency drives (VFDs) or load wiring. The CONTRACTOR shall coordinate with the VFD manufacturer to provide necessary separation of conductors or shielding and/or filtering equipment as required by the VFD manufacturer. If interferences do occur, the CONTRACTOR shall be responsible to take corrective action at no additional cost to the OWNER.

E. WIRING FOR VENDOR PACKAGES:

1. Equipment specifications indicate when the Vendor is responsible for providing interconnection wiring between components of a Vendor package that are installed on separate skids or assemblies. In this circumstance, interconnection wiring between skids or assemblies in a Vendor package is scheduled as "Vendor Wiring" in the conduit/cable schedules.

2. Where equipment specifications do not specify Vendor furnished wiring between skids or assemblies in a Vendor package, the CONTRACTOR shall provide and install interconnection wiring between skids or assemblies per the Vendor's interconnection wiring requirements. Interconnection wiring between skids or assemblies in a Vendor package that is furnished and installed by the CONTRACTOR is not scheduled in the conduit/cable schedules.

3. Determination of cable requirements.

   a. Coordinate cable/conductor requirements with the selected Vendors to determine the correct wiring required to interconnect the package system components/skids.

   b. Wiring between Vendor furnished components shipped on separate skids or assemblies shall conform to requirements specified in Division 25 and Division 26.

   c. Wiring between the plant control system and Packages system components/skids are specified in the conduit/cable schedules.

   d. Wiring between external power supplies and the packaged system components/skids are specified in the conduit/cable schedules.

4. Assign numbers and tagging for unscheduled raceway, and cable between Vendor furnished components on separate skids or assemblies as specified in Section 26 05 00. Coordinate this information in submittals, record drawings, and O&M manuals provided under this contract.

5. Contract documents shall be updated in the record drawing set to include the work provided for wiring the vendor packages.

1.13 BASIS OF DESIGN

A. The basis of the mechanical and electrical design is the installation of equipment and motors as shown in the electrical one-line drawing(s) and load/panel schedules. In the event that different equipment motors are provided in order for the vendor's equipment to meet

mechanical performance requirements, the CONTRACTOR shall coordinate various suppliers, vendors, and subcontractors to change the required electrical conduit, cables, breakers, motor control center sections, starters units and accessories, etc. as necessary to meet the vendor's equipment installation requirements of the National Electrical Code. The traits and characteristics of all provided materials, equipment, and devices shall meet the specifications. These changes to materials, equipment, and devices shall be at no cost to the OWNER. Electrical submittal information shall be coordinated with the equipment and motors provided.

1.14 ARC FLASH MITIGATION METHODS

A. The following mitigation method requirements shall apply to all power distribution and utilization equipment supplied for any products supplied on the project and applies to all equipment divisions in the Contract Documents. Refer to the NFPA-70 (NEC) and NFPA-70E (Electrical Safety in the Workplace) for equipment labeling requirements.

1. EQUIPMENT LABELS: Equipment labels shall be installed on the outside of the electrical equipment enclosure, cabinet, and panels to avoid opening the equipment to access the manufacture's data or the equipment ratings.

2. HINGED DOORS: Power distribution equipment shall have hinged rear doors where back access is shown.

3. REMOTE RACKING DEVICES: Switchboard SWBD-2 shall be provided with a remote racking device for Electricians to insert or remove rack- mounted breakers, rack-mounted devices, or auxiliary equipment drawers into the associated equipment location.

4. INSULATED POWER BUS AND INSULATED CABLE BOOTs:

   a. Provide insulated power bus in power distribution equipment where accessible to installers or maintenance workers.

   b. Provide cable boots for power conductor connections to insulate the exposed power conductor connections.

5. VIEW WINDOWS FOR MONITORING: Provide protected view windows into cabinets that allow infra-red analyzers, monitors, or cameras to monitor hot temperature for unusual heat generated by deteriorating connections. The view windows shall have a method to move the window protector and hold- in-place during the monitoring operation.

6. POWER AND CONTROL EQUIPMENT SEPARATION:

   a. Provide separation between power equipment within an enclosure, cabinet, or panel by the use of barriers, separate access doors, or by other means.

   b. Provide separation barriers between main breaker feeders coming in- to equipment and other termination points or bussing on the load side of the main breaker.

7. AUTOMATIC SHUTTERS: Provide automatic shutters, where possible, to close the access to the power bus when a power device is not engaged.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. GENERAL: Equipment and materials shall be new and free from defects. All material and equipment of the same or a similar type shall be of the same manufacturer throughout the work. Standard production materials shall be used wherever possible.

B. EQUIPMENT FINISH: Unless otherwise specified, electrical equipment shall be painted by the manufacturer as specified in Section 09 90 00.

C. GALVANIZING: Where specified, galvanizing shall be in accordance with Section 05 50 00.

2.2 WIRE MARKERS

A. Each power and control conductor shall be identified at each terminal to which it is connected. Conductors size No. 1 AWG or smaller shall have identification sleeves. Conductors No. 2 AWG and larger shall use cable markers of the locking tab type. Tabs shall be white plastic with conductor identification number permanently embossed.

B. Conductors shall be identified in accordance with Section 26 05 00. Adhesive strips are not acceptable.

C. The letters and numbers that identify each wire shall be machine printed on sleeves with permanent black ink with figures 1/8 inch high. Sleeves shall be yellow or white tubing and sized to fit the conductor insulation. Shrink the sleeves with hot air after installation to fit the conductor.

D. Conductor and Wire Marker Manufacture:

1. TMS Thermofit Marker System by Raychem Co
2. Sleeve style wire marking system by W. H. Brady Co.
3. Or approved equal

2.3 MC-HL CABLE AND RACEWAY TAGS

A. Tags shall be:

1. Manufactured of permanent metal or heavy mill plastic.

2. Fastened to the raceways at both ends of the tag with permanent fasteners.

a. Fastened to the raceways at both ends of the tag with permanent fasteners.

3. Tag numbers shall be 1-inch tall and machine printed. Hand labeled tags are unacceptable.

2.4 NAMEPLATES

A. Nameplates shall be provided on all electrical devices, including but not limited to motor control equipment, MCC cubicles/cells/buckets, control stations, junction boxes, panels, harmonic filters, instruments, disconnect switches, indicating lights, meters, and all electrical equipment enclosures.

B. Nameplates shall also be provided on all electrical panel interior equipment, including but not limited to relays, circuit breakers, power supplies, terminals, contactors, and other devices.

C. Equipment nameplates shall have both the equipment name and number.

D. Nameplates shall be made of 1/16-inch thick machine engraved laminated phenolic having black letters not less than 3/16" high on white background or as shown on the drawings or other sections of the specifications. Nameplates on the interior of panels shall be White Polyester with printed thermal transfer lettering and permanent pressure sensitive acrylic; TYTON 822 or approved equal. All nameplates shall include the equipment name and number (and function, if applicable).

E. Provide warning nameplates on all panels and equipment which contain multiple power sources. Lettering shall be white on red background.

F. Nameplates shall be secured to equipment with stainless steel screws/fasteners.

G. Nameplates for disconnect switches shall contain name and number as well as voltage, phases and colors of conductors.

2.5 TERMINAL BLOCKS

A. GENERAL:

1. GENERAL:

a. Terminal Blocks for all CONTRACTOR supplied equipment and devices shall be manufactured by Allen Bradley, Bussmann, Phoenix Contact, or approved equal.

b. Unless otherwise specified, terminal blocks shall be panhead strap screw type. Terminals shall be provided with integral marking strips which shall be permanently identified with the connecting wire numbers as shown on the drawings. Terminal blocks for P-circuits (power 120-600 volts) shall be rated not less than the conductor current rating and shall not be rated less than 600 volts AC. Terminal blocks for C-circuits (control and/or control power 120 volts or less) and S-circuits (signal) shall be rated not less than 20 amperes and shall not be rated less than 600 volts AC. Terminals shall be tin-plated. Insulating material shall be nylon. Terminal blocks shall be in accordance with section 26 27 16 for all electrical equipment.

c. Provide terminals for all wire connections to field wiring and internal power distribution. Analog loops that are 24 VDC powered shall have a knife switch to disable the loop if necessary.

d. Connections shall have compression terminals capable of terminating 2 #14 AWG stranded wires. Terminals shall be DIN rail strip mounted as manufactured by Phoenix Contact, or approved equal. Provide number strips for terminal blocks that are referenced by the wire marker. Provide bridge bars for jumpers between terminal blocks. Provide end clamps to separate and terminate terminal block groups. Provide end covers for groups of terminal blocks in sets to match the number points associated with individual I/O cards in the PLC block.

e. Provide Separation Plates on each side of terminals that are at a different potential or polarity than surrounding terminals.

f. Provide clear plastic DIN rail mounted nametag stanchions for each block of terminations. Each nametag shall hold a preprinted label designating the PLC bus and PLC block that terminates to that set of terminals.

g. Terminals shall be mounted such that there is a minimum of 1.5 inches of clear space on both sides of the terminal; for ease of wiring.

h. Mount all terminals strips on 2-inch standoffs.

i. Provide 10 spare terminals or 5% whichever is the greater amount, spare (non-installed) replacement terminals for each type used.

j. Provide wired terminals to match the number of points supplied on each installed I/O card or spare slot in a PLC cabinet.

B. DIGITAL TERMINALS:

1. Terminal Blocks for use in general purpose and digital input terminations shall be Phoenix Contact UK 5, or approved equal. Provide double high terminals for general purpose.

2. Where space is limited for the required number of digital input points double high terminals are permitted if first approved by the OWNER.

C. ANALOG TERMINALS:

1. Terminal Blocks for use in analog input terminations shall be knife disconnect, with socket for analog isolator Phoenix Contact URELG-PMTK, or approved equal.

2. Terminal blocks for analog outputs shall be fused, double high with a separate ground terminal.

3. The wire used for analog inputs and outputs shall be multi-conductor #18 twisted pairs with an overall shield. Provide 4 & 8 pairs to match the input or output cards. Wire pairs shall be numbered and colored red for + and black for -. Use BELDEN-M 9520 CMG or approved.

D. FUSED TERMINALS:

1. Fuse terminal blocks shall be hinged disconnect level type with “blown fuse” indicators. PHOENIX CONTACT UK 5 HESI series, or approved equal.

PART 3 EXECUTION

3.1 GENERAL

A. CONSTRUCTION

1. The work under Division 26 shall be performed in accordance with these specifications.

2. Unless otherwise detailed or dimensioned, electrical layout drawings are diagrammatic. The CONTRACTOR shall coordinate the field location of electrical material or equipment with the work of other disciplines and subcontractors. Minor changes in location of electrical material or equipment made prior to installation shall be made at no cost to the OWNER.

3. The CONTRACTOR shall perform core drilling required for installation of raceways through concrete walls and floors. Locations of floor penetration, as may be required, shall be based on field conditions. Verify all exact core-drilling locations based on equipment actually furnished as well as exact field placement.

4. The CONTRACTOR shall seal all roof penetrations in accordance with approved sealing means.

B. HOUSEKEEPING:

1. Electrical equipment shall be protected from dust, water and damage. Motor control centers, switchgear, and buses shall be wiped free of dust and dirt, kept dry, and shall be vacuumed on the inside within 30 days of acceptance of the work.

2. Before final acceptance, the CONTRACTOR shall touch up any scratches on equipment as specified in Section 09 90 00.

3. Electrical equipment temporarily exposed to weather, debris, liquids, or damage during construction shall be adequately protected.

C. ELECTRICAL EQUIPMENT LABELING:

1. Electrical equipment shall have field marked signs and labeling to warn qualified persons of the potential electric arc flash hazards per NEC Article 110.16 Flash Protection.

2. Electrical equipment shall have NFPA 70E labels installed stating the results of the Arc Flash analysis specified in Section 26 05 73.

3. Electrical distribution equipment and utilization equipment shall be provided with field labels to identify the power source and the load as specified. Refer to NEC Article 110.22 for Identification of Disconnecting Means installation criteria. Specific information is required such as the equipment tag number and equipment description of both the power source and the load equipment.

D. MOTOR CONNECTIONS: Verify that the motors are purchased with the correct size motor termination boxes for the circuit content specified in the conduit and cable schedules or submit custom fabrication drawing indicating proposed motor termination box material, size, gasket, termination kit, grounding terminal, boot type insulated motor lead connection (T&B type MSC, or approved equal), and motor terminal box connection/support system. Verify the motor termination box location prior to raceway rough-in.

E. CONDUCTOR INSTALLATION: An enclosure containing disconnecting means, overcurrent devices, or electrical equipment shall not be used as a wireway or raceway for conductors not terminating within the enclosure. Provide wireways, raceways, termination boxes, or junction boxes external to the enclosure for the other conductors.

3.2 TESTING

A. GENERAL: Prior to energizing the electrical circuits, insulation resistance measurements tests shall be performed using a 1000-volt megohmmeter to verify the conductor is acceptable for use on the project. The test measurements shall be recorded on the specified forms and provided in accordance with Section 26 05 00.

B. INSULATION RESISTANCE MEASUREMENTS:

1. GENERAL:

a. Insulation resistance measurements shall be made on conductors and energized parts of electrical equipment (600V or less). 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.

b. Insulation resistance measurements shall be recorded. Insulation with resistance of less than 10 megohms is not acceptable.

2. CONDUCTOR AND CABLE TESTS: The phase-to-ground insulation resistance shall be measured for all circuits rated 120 volts and above except lighting circuits. Measurements may be made with motors and other equipment connected. Solid state equipment shall be disconnected, unless the equipment is normally tested by the manufacturer at voltages in excess of 1000 volts DC.

3. MOTOR TESTS: Installed motors shall be tested per Section 26 08 00 shall be completed for each motor after installation. Motors shall have their insulation resistance measured before they are connected. Motors 50 HP and larger shall have their insulation resistance measured at the time of delivery as well as when they are connected. Insulation resistance values less than 10 megohms are not acceptable.

C. PRE-FUNCTIONAL TEST CHECKOUT: Functional testing shall be performed in accordance with the requirements of Section 26 08 00. Prior to functional testing, all protective devices shall be adjusted and made operative.

1. Submit a description of the proposed functional test procedures prior to the performance of functional checkout.

2. Prior to energization of equipment, perform a functional checkout of the control circuit. Checkout:

a. Energizing each control circuit.
b. Operating each control device, alarm device, or monitoring device.
c. Operate each interlock to verify that the specified action occurs.

D. Verify motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor, provided the CONTRACTOR confirms that neither the motor nor the driven equipment will be damaged by reverse operation or momentary energization.

END OF SECTION

SECTION 26 05 05 - SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies requirements for selective demolition of portions of the electrical system at the facility. This may include such things as underground conduit, surface conduit, motors, control components and similar.

B. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Demolition
5. Relocation

1.2 SCOPE

A. Verify with the OWNER all items to be salvaged. All items that are not directed in the field (or by other means) to be salvaged or turned over to the OWNER shall be considered scrap. Carefully inspect the entire site and verify all items to be removed, to remain, or to be relocated.

B. Demolition work shall be the responsibility of each trade's CONTRACTOR. Notify the project manager at least two days prior to commencing work in a particular area.

C. Coordinate and schedule all work in a careful manner with all necessary consideration for the OWNER, other CONTRACTORs and the public, avoiding interference with the use of, and passage to and from, adjacent areas and facilities designated to remain in use during demolition.

D. Maintain all existing circuits to items that remain in use. Reroute and rework all conduits, wiring, etc. as required.

1.3 REFERENCE STANDARDS

A. NFPA 70 National Electrical Code
B. NFPA 70E National Electrical Safety Code

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

1.5 DEMOLITION

A. Demolish and remove equipment foundation and supports, conduits, wire, and all other existing items designated for removal as indicated on the drawings and in these specifications. Do not use equipment or methods that will cause damage to adjacent construction designated to remain.

B. Existing outlets which are to be removed and have conduits rising from the floor slab shall have the conduits cut below floor level. Abandon or rework as required to provide feedthrough service to other remaining outlets. Pull new wire between remaining outlets affected by feed-through. Patch floor as required to restore to original condition.

C. Abandoned outlet boxes shall be closed with blank cover plates. If equipped with devices, the devices shall be removed and the conductors removed to the adjacent outlet or reconnected as required to provide feed-through service.

D. Disconnect and remove existing conduit and wiring feeding removed lights back to source or to fixtures to remain in use. Disconnect all devices in or on walls to be removed. All existing wiring systems which are disconnected and designated for removal shall be completely removed back to source.

E. Pull conductors from abandoned concealed raceway systems. Any section of raceway system exposed due to remodeling shall be cut flush at exposing surface. Concealed raceways need not be removed except where they interfere with remodeling.

F. Disconnect all electrical connections to equipment designated to be removed by other trades.

G. The drawings indicate the general concept of the demolition to be performed, and are not intended to be totally inclusive. The CONTRACTOR is responsible to visit the site and fully inform himself of all demolition requirements.

1.6 RELOCATION

A. All existing outlets, equipment and associated wiring and conduit system(s) which interfere with the work of the electrical, general, structural, plumbing, fire protection, or HVAC CONTRACTORs shall be reworked as required to maintain system operation and facilitate the scheduled work.

B. All electrical equipment devices, and lighting fixtures that are to be relocated shall be carefully removed, stored, installed in new location and reconnected, relamped and cleaned.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE CONDUCTORS, WIRES AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Definitions.
5. Submittals.
6. Products.
7. Execution.

1.2 SCOPE

A. This section specifies cables and conductors including:

1. Stranded copper cables, conductors, and wire rated 600 volts insulation used for power; lighting, analog, digital, or pulse signals and control circuits.

2. Copper cables and coax cable rated 300-volt insulation used for data, communication, and signaling.

1.3 REFERENCE STANDARDS

A. 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.

B. 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.

1. 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 B3	Soft or Annealed Copper Wire
ASTM B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
ICEA S-95-658/ NEMA WC70	Non-shielded 0-2kV Cables
NFPA 70	National Electric Code (NEC)

Reference	Title
IEEE 383	Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations
UL 44	Rubber-Insulated Wires and Cables
UL 83	Thermoplastic-Insulated Wires and Cables
ANSI X3.166	Information Systems--Fiber Data Distributed Interface (FDDI)--Token Ring Physical Layer Medium Dependent (PMD)
EIA RS232D	Interface Between Data Terminal Equipment and Data Circuit Terminating Equipment Employing Serial Binary Data Interchange
EIA RS422	Electrical Characteristics of Balanced Voltage Digital Interface Circuits
EIA RS485	Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems
IEEE 802	IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture
IEEE 802.3	Information Processing Systems--Local and Metropolitan Area Networks--Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD Access Method and Physical Layer Specifications
IEEE 802.3k	Supplement to ISO/IEC 8802-3, Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications: Layer Management for 10 Mb/s Baseband Repeaters
IEEE 802.4	Information Processing Systems--Local Area Networks--Part 4: Token-Passing Bus Access Method and Physical Layer Specifications
ANSI/NFPA 72	Installation, Maintenance, and Use of Protective Signaling Systems
ANSI/NFPA 72H	Testing Procedures for Signaling Systems

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from the date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 DEFINITIONS

A. LOW LEVEL ANALOG: A signal that has a full output level of 100 millivolts or less. This group includes thermocouples and resistance temperature detectors.

B. DATA OR DIGITAL CODE: Coded information such as that derived from the output of an analog to digital converter or the coded output from a digital computer or other digital transmission terminal. This type includes those cases where direct line driving is utilized, such as EIA RS422.

C. PULSE FREQUENCY: Counting pulses such as those emitted from speed transmitters.

D. HIGH LEVEL ANALOG: Signals with full output level greater than 100 millivolts but less than 30 volts, including 4-20 mA transmission.

E. MODULATED SIGNALS: Signals emanating from modems or low-level audio signals. Normal signal level is plus 4 dBm to minus 22 dBm. Frequency range is 300 to 10,000 hertz.

F. DISCRETE EVENTS: Dry contact closures monitored by solid state equipment. If the conductors connecting to dry contacts enter enclosures containing power or control circuits and cannot be isolated from such circuits in accordance with NEC Article 725, this signal shall be treated as low voltage control.

G. LOW VOLTAGE CONTROL: Contact closures monitored by relays, or control circuits operating at less than 30 volts and 250 milliamperes.

H. HIGH LEVEL AUDIO SIGNALS: Audio signals exceeding plus 4 dBm, including loudspeaker circuits.

I. RADIO FREQUENCY SIGNALS: Continuous wave alternating current signals with fundamental frequency greater than 10 kilohertz.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

4. Catalog cuts showing information of the conductors and cables to be sup- plied under this section.

5. Field test reports showing conductor and cable insulation resistance test results.

6. Provide engineering pull calculations for all 600V main feeders run underground outside building footprints.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers are listed in the Cable Specification Sheets located at the end of this specification section.

2.2 GENERAL

A. UNSCHEDULED CONDUCTORS AND CABLES:

1. With the exception of lighting and receptacle circuits, the type, size and number of conductors shall be as specified on the drawings or schedules. 120V panel circuit conductors mentioned above that are unscheduled and shall be sized by the CONTRACTOR in accordance with the breakers specified and the NEC to limit voltage drop to 3 percent. Minimum size of power, lighting, and receptacle circuits shall be 12 AWG. Number and types of communication, paging, and security cables shall be as required for the particular equipment provided. Power, lighting, and receptacle circuit conductors shall be provided in accordance with CABLESPEC “XHHW,” unless otherwise specified.

2. Where not specified on the Drawings, conductors and cables shall be sized in accordance with the National Electrical Code for the particular equipment served with the minimum size as specified herein. Unscheduled conductors shall be sized by the CONTRACTOR in accordance with NEC tables and to limit voltage drop to 3 percent.

3. Unscheduled conductors with insulation shall be provided in accordance with the CABLE SPECIFICATIONS in TABLE 2 according to the purpose.

B. CABLE SPECIFICATION SHEETS (CABLESPEC): General requirements for conductors and cables specified in this Section are listed on CABLESPEC sheets.

2.3 COLOR CODING

A. POWER AND CONTROL CABLES:

1. Wire coloring shall conform to the color code shown in the table below.

2. Insulation on phase conductors run in conduits sizes #10 AWG and smaller shall be colored, #8 AWG and larger may have black insulation with plastic tape of the appropriate color from the table below.

3. Insulation on the grounded conductor (neutral) sizes #8 AWG and smaller shall be colored, #6 AWG and larger may have black insulation with plastic tape of white or gray in accordance with the table below.

Description	120/208V	277/480V	Control
Phase A (Left)	Black	Brown	--
Phase B (Center)	Red	Orange	--
Phase C (Right)	Blue	Yellow	--
Neutral	White	Gray	White
Ground	Green	Green	Green
120 VAC Control	--	--	Red
120 VAC Control Neutral	--	--	White
DC Control (+)	--	--	Blue
DC Control (-)	--	--	Gray
Signal (+)	--	--	Red
External Source	--	--	Yellow
Computer/Signal Ground			Green/yellow stripe

4. All control wiring in control panels or other enclosures that is powered from an external source and is not disconnected by the control panel disconnect shall be terminated at a disconnecting terminal block upon entering the enclosure. The color of the wire shall then be changed to yellow to identify it as being powered from an external source. Provide identification nameplate on exterior of enclosure to indicate sources of external power.

5. All wiring in industrial machines and equipment shall be in accordance with NFPA 79. Notify OWNER of any deficiencies noted during installation.

6. Multi-conductor power cable colors shall be manufacturer's standard.

7. Cables sized No. 6 AWG and larger may be black with colored 3/4-inch vinyl plastic tape applied in 3-inch lengths around the cable at each end. The cables shall be tagged at terminations and in pull boxes, hand holes and manholes.

B. SIGNAL AND DATA CABLES: Unless otherwise specified, cables shall be color coded black and white for pairs or black, red, and white for triads.

2.4 POWER AND CONTROL CONDUCTORS AND CABLE, 600 VOLT

A. SINGLE CONDUCTOR: Single conductor cable shall be stranded copper and shall be used in conduits for power and control circuits. Single conductor cable shall be provided in accordance with CABLESPEC "XHHW" type of conductors unless otherwise specified.

B. MULTI-CONDUCTOR CABLE: Provide multi-conductor power cable and multi-conductor control cable where identified on the drawings. Multi-conductor cables shall be in accordance with CABLESPEC "TC" type cables.

2.5 SIGNAL, DATA AND INSTRUMENTATION CABLES

A. GENERAL:

1. Signal cable shall be provided for instrument signal transmission, alarm, communication, and other circuits as specified. Circuit shielding shall be provided in addition to cable shielding.

2. Single circuit signal cable shall be provided in accordance with CABLESPEC "INS," unless otherwise specified for hazardous locations type "SP-OS" (ITC/PLTC). Multi-circuit signal cable shall be provided in accordance with CABLESPEC "INS/M," unless otherwise specified for hazardous locations type "SP-OS" (ITC/PLTC).

3. Terminal blocks shall be provided at cable junction for running signal leads and shield drain wires. Each conductor shall be identified at such junctions.

a. Shields shall not be used as a ground path.

b. Shields shall be grounded at one end only. Refer to I drawings for grounding location.

c. Signal, data, and communication cables shall be terminated and spliced on terminal strips properly mounted and labeled in accordance with this Section and Section 26 05 00. No exceptions.

4. CABLE SPECIFICATION SHEETS (CABLESPEC): General requirements for conductors and cables specified in this Section are listed on CABLESPEC sheets in Section 26 05 19-3.07.

2.6 WIRE MARKERS

A. 600 VOLT AND 300 VOLT RATED CONDUCTORS:

1. Per 26 05 00 Paragraph 2.2.

2.7 SPLICING AND TERMINATING MATERIALS

A. 600-VOLT AND 300-VOLT RATED CONDUCTORS:

1. Connectors shall be tool applied compression type of correct size and UL listed for the specific application. Connectors shall be tin-plated high conductivity copper. Connectors for wire sizes No. 10 AWG and smaller shall be nylon self-insulated, ring tongue or locking-spade terminals. Connectors for wire sizes No. 8 AWG and larger shall be one-hole lugs up

to size No. 3/0 AWG, and two-hole or four-hole lugs for size No. 4/0 and larger. Mechanical clamp, dimple, screw-type connectors are not acceptable.

2. In-line splices and taps shall not be used. All circuits shall be continuous though all junction boxes, wireways, pull boxes, etc. until the circuit conductors are terminated at suitable terminal strips within motor control centers, PLC cabinets and panels, distribution panels, local control stations, etc.

3. Motor terminations at 460-volt motors shall be made by bolt-connecting the lugged connectors. Connections shall be insulated with Thomas and Betts (T&B), MSC series Motor Stub Splice Insulators and sealed with the appropriate tape for the motor voltage. (Example 480V = Scotch 33).

2.8 CORD GRIPS

A. Cord grips shall be provided where specified on the Drawings to attach flexible cord to equipment enclosures. Cord grips shall consist of a threaded aluminum body and compression nut with a neoprene bushing and stainless-steel wire mesh for strain relief. Cord grip shall provide a watertight seal at enclosure interface and sized to accommodate the flexible cord.

2.9 VFD WIRING

A. Shielded power cables (TYPE VFD2/3) shall be used for load-side wire between the VFDs and the motors.

PART 3 EXECUTION

3.1 GENERAL

A. Conductors shall be identified at each connection terminal and at splice points. The identification marking system shall comply with Section 26 05 00.

B. Pulling wire and cable into conduit or trays shall be completed without damaging or putting undue stress on the insulation or jacket. Manufacture recommended and UL Listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable.

C. Raceway construction shall be complete, cleaned, and protected from the weather before cable is installed. Where wire or cable exits a raceway, a wire or cable support shall be provided.

D. Provide tin-plated bus bar. Scratch-brush the contact areas and tin plate the connection where flat bus bar connections are made with un-plated bar. Bolts shall be torqued to the bus manufacturer's recommendations.

3.2 600-VOLT CONDUCTOR AND CABLE

A. Conductors in panels and electrical equipment shall be bundled and laced at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Lacing is not necessary in plastic panel wiring duct or wall mounted steel raceway used above countertops. Lacing shall be made up with plastic cable ties. Cable ties shall be tensioned and

cut off by using a tool specifically designed for the purpose such as a Panduit GS2B. Other methods of cutting cable ties are unacceptable.

B. Conductors crossing hinges shall be bundled into groups not exceeding 10 to 15 conductors and protected using nylon spiral flexible covers to protect conductors. Provide oversized plastic panel wiring duct within panels and panelboards.

C. Slack shall be provided in junction and pull boxes, hand holes and manholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls. Amount of slack shall be equal to largest dimension of the enclosure. Provide dedicated electrical wireways and insulated cable holders mounted on unistrut in manholes and hand holes.

D. Raceway fill limitations shall be as defined by NEC and the following:

1. Lighting and receptacle circuits may be in the same conduit in accordance with de-rating requirements of the NEC. Lighting and receptacle circuits shall not be in conduits with power or control conductors. Signal conductors shall be in separate conduits from power and control conductors. Motor feeder circuits shall be in separate conduits including small fan circuit unless combination fan-light fixture.

2. Power conductors derived from uninterruptible power supply systems shall not be installed in raceways with conductors of other systems. Install in separate raceways.

3. Splices and terminations are subject to inspection by the OWNER prior to and after insulating.

4. Motor terminations at 460-volt motors shall be made by bolt-connecting the lugged connectors.

5. In-line splices and tees, where approved by the Owner, shall be made with tubular compression connectors and insulated as specified for motor terminations. Splices and tees in underground hand holes or pull boxes shall be insulated using Scotch-cast epoxy resin or Raychem splicing kits.

6. Terminations at solenoid valves, 120-volt motors, and other devices furnished with pigtail leads shall be made using self-insulating forked compression connectors and terminal strips within a termination/junction box.

7. Terminations at valve and gate motor actuators shall be made directly into the actuator where possible. Power termination shall be made in the actuator power disconnect. Control and signal cable may be routed to a termination box near the actuator on 20-ampere rated terminal strips with label identification for the control and signal conductors. Single wire control conductors and analog cable (INS or INS/M) then installed in flexible conduit to the actuator control and signal termination compartments.

8. Solid wire shall not be used.

9. Sharing neutrals for power circuits is unacceptable.

10. Conductor and cable markers shall be provided at splice points.

3.3 SIGNAL CABLE

A. Circuits shall be run as individually shielded twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever 3-wire circuits are required. Terminal blocks shall be provided at instrument cable junctions, and circuits shall be identified at such junctions unless otherwise specified. Signal circuits shall be run without splices between instruments, terminal boxes, or panels.

B. Shields shall not be used as a signal conductor.

C. Common ground return conductors for two or more circuits are not acceptable.

D. Unless otherwise specified, shields shall be bonded to the signal ground bus at the control panel and isolated from ground and other shields at other locations. Terminals shall be provided for running signal leads and shield drain wires through junction boxes.

E. Cable for communication systems shall be installed and terminated in compliance with the equipment manufacturer's recommendations and applicable NEC requirements.

F. Cable for data circuits and operating at greater than 10 kHz, shall be run continuously from node to node without splices or intermediate terminal blocks unless otherwise specifically specified or shown.

G. Cable for low-level instrumentation circuits shall be run continuously between final terminations without splices or intermediate terminal blocks unless otherwise specifically shown or specified.

H. Spare circuits and the shield drain wire shall be terminated on terminal blocks at both ends of the cable run and be electrically continuous through terminal boxes. Shield drain wires for spare circuits shall not be grounded at either end of the cable run.

I. Terminal boxes shall be provided at instrument cable splices. If cable is buried or in raceway below grade at splice, an instrument stand shall be provided as specified with terminal box mounted approximately 3 feet above grade.

3.4 INSTALLATION

A. Raceway fill shall be as scheduled, and shall not exceed NEC limitations.

B. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:

1. Where specifically indicated on the drawings.

2. Where field conditions dictate and written permission is obtained from the Owner.

3. Control circuits shall be isolated from the feeder and branch power and instrumentation circuits but combining of control circuits with power is permitted as noted below.

a. The combinations shall comply with the following:

1) 12 VDC, 24 VDC and 48 VDC may be combined.

2) 125 VDC shall be isolated from all other AC and DC circuits.
3) All AC circuits shall be isolated from all DC circuits.

4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.

   a. The combinations shall comply to the following:

      1) Analog signal circuits may be combined.
      2) Digital circuits may be combined but isolated from analog signal circuits.

5. Multiple branch circuits for lighting, receptacle and other 120 VAC circuits are allowed to be combined into a common raceway.

   a. CONTRACTOR is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NEC, including but not limited to:

      1) Up sizing conductor size for required Ampacity de-ratings for the number of current-carrying conductors in the raceway.

      2) The neutral conductors may not be shared.

      3) Up sizing raceway size for the size and quantity of conductors.

C. Pulling wire and cable into conduit or cable trays shall be completed without damaging or putting undue stress on the cable insulation. Only UL listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable. Raceway construction shall be complete, cleaned, and protected from the weather before cable is placed.

D. Whenever a cable leaves a raceway, a cable support shall be provided. Conductors in panels and electrical equipment shall be bundled and laced at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Lacing shall be made up with plastic cable ties. Lacing is not necessary in plastic panel wiring duct. Conductors crossing hinges shall be bundled into groups not exceeding 12 and shall be so arranged that they will be protected from chafing when the hinged member is moved.

E. Slack shall be provided in junction and pull boxes, hand holes and manholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls of the box. Amount of slack shall be equal to largest dimension of the box. Where plastic panel wiring duct is provided for wire runs, lacing is not required. Plastic panel wiring duct shall not be used in manholes and hand holes.

F. Do not exceed cable manufacturer's maximum recommended pulling tension. Use dynamometer or break-away swivel on pulls exceeding 150 feet.

G. Observe manufacturer's minimum recommended pulling and training radii.

H. Where data cables are installed in cable trays, provide barriers in the tray to separate data cables from power and/or control cables.

I. At each end of the run leave sufficient cable for termination. Coil sufficient cable in each manhole, handhold, or pull box to permit future splice.

J. In-line splices and tees are not allowed.

K. Splices shall not be permitted in any coaxial, twin-axial, or data cable runs.

L. Ground cable shields at one end only. Unless otherwise specified, ground the shields at the panel end.

M. Protect all cables against moisture during and after installation.

N. Install and ground Ethernet cable in accordance with IEEE 802.3. Attach trunk cable to walls and ceilings with PVC clamps with clamp backs at 4-foot intervals.

O. Signal and control cable suspended into the wet well shall be provided with heavy duty wire mesh cord grip of flexible stainless-steel wire to take the tension from the cable termination. Strain relief system shall be suitably anchored.

P. Circuits provided under this Section shall not be direct buried.

3.5 TERMINATIONS

A. Terminations shall be on terminators as identified in Section 26 05 00.

B. Each conductor shall be identified with a wire marker at each terminal to which it is connected. The marking system shall comply with Section 26 05 00.

C. Stranded conductors shall be terminated as described in Section 26 05 19, except where terminals will not accept such terminations. Compression lugs and connectors shall be installed using manufacturer's recommended tools. Where terminal blocks will not accept lugged conductors, the conductors shall be tinned using 60 percent tin, 40 percent lead alloy non-corrosive resin core solder before insertion into pressure terminals.

D. Electrical spring connectors (wire nuts) shall not be used for any purpose on any cable specified under this Section except for receptacle and lighting circuits. Lugs and connectors shall be installed with a compression tool.

E. All splices and terminations are subject to inspection by the OWNER prior to and after insulating.

F. Terminations at solenoid valves, 120-volt motors, and other devices furnished with pigtail leads shall be made using self-insulating forked compression connectors and terminal strips within a termination/junction box.

G. Provide tool-crimp N connectors at coaxial cable terminations except trunk runs. Verify existing coax termination connections on existing antenna and match appropriately.

H. Provide tool-crimp TRN connectors at twin-axial cable terminations.

I. Conductor and cable markers shall be provided at splice points.

3.6 TESTING

A. GENERAL:

1. The CONTRACTOR shall test conductors and cable in accordance with Section 26 08 00. Instrument and Data Cables shall be subjected to additional tests as specified in this section.

B. INSTRUMENT CABLE:

1. Each signal pair or triad shall be tested for electrical continuity. Any pair or triad exhibiting a loop resistance of less than or equal to 50 ohms shall be deemed satisfactory without further test. For pairs with greater than 50-ohm loop resistance, the CONTRACTOR shall calculate the expected loop resistance considering loop length and intrinsic safety barriers if present. Loop resistance shall not exceed the calculated value by more than 5 percent.

2. Each shield drain conductor shall be tested for continuity. Shield drain conductor resistance shall not exceed the loop resistance of the pair or triad.

3. Each conductor (signal and shield drain) shall be tested for insulation resistance with all other conductors in the cable grounded.

4. Instruments used for continuity measurements shall have a resolution of 0.1 ohms and an accuracy of better than 0.1 percent of reading plus 0.3 ohms. A 500-volt megohmmeter shall be used for insulation resistance measurements.

3.7 CABLE SPECIFICATION SHEETS (CABLESPEC)

A. GENERAL: Conductor, wire, and cable types for different locations, service conditions and raceway systems are specified on individual cable specification sheets. Scheduled and unscheduled conductors, wires, and cables shall be installed in accordance with the CABLESPEC SHEETS.

B. CABLESPEC SHEETS: The following CABLESPEC sheets are included in this section:

CABLESPEC	Volts	Product	Purpose
TC	600	Multi-conductor armored power and control cable	Power and control conductors for use in cable trays and hazardous areas.
XHHW	600	Single conductor cross- linked polyethylene power and control cable	Power and control conductors for use in conduit raceways.
VFD2	600	Shielded motor cable for VFD drives	Feeding motors fed from VFD drive for use in Conduit raceways and Cable Tray.
VFD3	600	Shielded motor cable for VFD drives for large HP motors	Feeding motors fed from VFD drive for use in Conduit raceways and Cable Tray.
CORD	600	Rubber Jacketed multi- conductor cable.	Temporary power cable.
INS	600	Single Pair/Triad #18 ST plus overall shield,	Instrumentation
INS/M	600	Multiple Pair/Triad #18STP plus overall shield,	Instrumentation
NC2	300	Category 6 Ethernet cable, 4 pairs, non-armored	Gigabit Ethernet cable
NC3	300	Category 6 Ethernet cable, 4 pairs, Shielded	Gigabit Ethernet cable
IT	300	350 MHz Enhanced Cat 6	Gigabit Ethernet, LAN cable.

CABLE SPECIFICATION SHEETS (CABLESPECs) begin on next sheet:

Cable System Identification: TC

Description:	Multiconductor Power Cable and Multiconductor Control Cable:14 AWG and larger stranded conductors; Cable tray rated.
Power Cable:	Insulated green grounding conductor sized per the NEC.
Ground Conductor Size:	Multiple sets of multiconductor power cable: Oversize the grounding conductor per NEC 250.
Control Cable Type:	ICEA Method 1, E-2, without white neutral conductor or green ground conductor
Control Cable Identification:	Conductors color coded per ICEA and conductors numbered
Voltage:	600 volts
Conductor Material:	Bare annealed copper; stranded per ASTM B8, coated per ASTM B33
Insulation:	XHHW-2, 90 degree C dry, 75 degree C wet, cross-linked polyethylene in accordance with NEMA WC7, UL 44 and ICEA S-66-524.
Jacket:	Cross-linked Polyethylene (XLP)
Flame Resistance:	IEEE 383
Manufacturer(s):	Okonite, Southwire, General Cable, or approved equal.
Execution:	
Installation:	Install in accordance with this Section.
Testing:	Test in accordance with accordance with this Section and Sections 26 05 00 and 26 08 00.

Cable System Identification: XHHW

Description:	Single conductor Cross-linked polyethylene power and control cable for sizes No. 14 AWG and larger.
Voltage:	600 volts
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 ICEA S-95-658/NEMA WC70.
Jacket:	None.
Manufacturer(s):	Okonite, X-Olene; Durasheath XLP; or approved equal
Uses Permitted:	Power, control, lighting, receptacle and appliance circuits
Execution:	
Installation:	Install in accordance with Section 26 05 19.
Testing:	Test in accordance with this Section and Sections 26 05 00.

Cable System Identification: VFD2

Description:	Shielded motor cable for VFD drives.
Voltage:	600V
Conductor	Finely stranded tinned copper Class 5 stranded: 16-8 awg, and Class K stranded: 2, 4 & 6 awg. Provide pilot or control conductors integral to VFD cable as described in the circuit schedule, shown on the drawings or as required for individual applications.
Material:	
Insulation:	90 degree C dry or wet, cross-linked polyethylene XPLE in accordance with NEMA.
Assembly:	Individual conductors cabled together with barrier tape, 100% shielding with foil tape and tinned copper braid (85% coverage) inside specially formulated thermoplastic elastomer (TPE) black jacket.
Jacket:	TPE black jacket UL listed to -25 deg C, UL TC-ER listed

Minimum bend radius of 7.5x overall cable diameter.

Flame	IEEE 383
Resistance:	
Manufacturer(s):	Olflex VFD 2XL Belden 295XX SAB Cables – VFD Combo XLPE (includes up to 2 pr of control conductors) Lutz - Driveflex (includes up to 2 pr of control conductors) or approved equal.
Uses Permitted:	Cable tray, conduit, exposed in normal or Class 1, Div 2 per NEC 336, 392 and 501 environments
Execution:	
Installation:	Install in accordance with this Section. Provide cable seals where required by NEC 501.
Testing:	Test in accordance with this Section and Sections 26 05 00.

Cable System Identification: VFD3

Description:	Large HP shielded motor cable for VFD drives.
Voltage:	600V
Conductor	Class B finely stranded tinned copper 1 awg through 500 kcmil Symmetrical grounds
Insulation:	90 degree C dry or wet, cross-linked polyethylene XPLE in accordance with NEMA.
Assembly:	Individual conductors cabled together with barrier tape, longitudinal copper tape inside specially formulated thermoplastic elastomer (TPE) black jacket.
Jacket:	TPE black jacket UL listed to -25 deg C, UL TC-ER listed. Minimum bend radius of 15x overall cable diameter. UL 1277, UL 44 listed.
Flame	IEEE 383
Resistance:	
Manufacturer(s):	Olflex VFD 2XL Belden 295XX or approved equal.
Uses Permitted:	Cable tray, conduit, exposed in normal or Class 1, Div 2 environment.
Execution:	
Installation:	Install in accordance with this Section
	Provide cable seals where required by NEC 501.
Testing:	Test in accordance with this Section and Sections 26 05 00.

Cable System Identification: CORD

Description:	Portable Cord, 3-conductor with ground, extra hard usage, oil, weather and water resistant. 10 AWG and smaller, UL listed, type SOOW; larger than 10 AWG, UL listed type G
Voltage:	600 volts
Conductor Material:	Type G - Flexible rope lay stranded per ASTM B189 and B33. Type SOOW – Soft bare annealed copper per ASTM B-3, flexible bunch strand per ASTM B-174.
Insulation:	Insulation shall be ethylene propylene (EPR) as per ICEA S-68-516 and rated for continuous operation at 90 degrees C.
Jacket:	Black chlorinated polyethylene (CPE) rubber ICEA S-98- 658.
Manufacturer(s):	Type SOOW - Houston Wire HW250, Southwire Viper, or approved equal. Type G – Houston Wire HW258, Southwire Type G, or approved equal,

Execution:

Installation:	Install in accordance with Section 26 05 19.
Testing:	Test in accordance with Sections 26 05 00.
Sizing Cables:	Cables shall be sized for loads to be served.

Cable System Identification: INS

Description:	Single twisted, shielded pair or triad, 18 AWG, instrumentation cable, rated for wet and dry locations.
Voltage:	600 volts
Conductor Material:	Bare annealed copper; stranded in accordance with ASTM B8
Insulation:	PVC/Nylon
Shield:	100 percent, 1.35 mil aluminum-Polyester tape with 20 AWG 7-strand tinned copper drain wire
Jacket:	48 mil flame-resistance polyvinylchloride
Flame Resistance:	UL 1685, ICEA T-29-520 and IEEE 1202.
Manufacturer(s):	Single Pair: BELDEN 1120A, or approved equal. Single Triad: BELDEN 1121A, or approved equal.

Execution:

Installation:	Install in accordance with Section 26 05 19.
Testing:	Test in accordance with this Section and Sections 26 05 00.

Cable System Identification: INS/M

Description:	Multiple twisted, shielded pairs or triads, instrumentation cable, rated for wet and dry locations.
Voltage:	600 volts
Conductor Material:	Bare annealed copper; stranded in accordance with ASTM B8
Lay:	Length 2.5 inches
Insulation:	PVC/Nylon
Shield:	100 percent, 1.35 mil aluminum-Polyester tape with 18 AWG 7-strand tinned copper drain wire
Jacket:	48 mil or 68 mil or 84 mil flame-resistance polyvinylchloride
Flame Resistance:	UL 1685and IEEE 1202.
Manufacturer(s):	2 pair: BELDEN 1048A, or approved equal. 4 pair: BELDEN 1049A, or approved equal. 12 pair: BELDEN 1051A, or approved equal 4 triad: BELDEN 1093A, or approved equal. 12 triad: BELDEN 1095A, or approved equal.
Execution:	
Installation:	Install in accordance with Section 26 05 19.
Testing:	Test in accordance with this Section and Sections 26 05 00.

Cable System Identification: NC2

Description:	Paired – MediaTwist Enhanced Category 6, gigabit Ethernet, 100BaseTX, 4 pair cable, non-armored
Voltage:	300V rms
Conductor Material:	Tinned copper 24 AWG
Insulation Material:	Polyolefin (PO)
Shield:	Unshielded
Jacket:	Polyvinyl chloride (PVC), 0.365x0.165-inch diameter
Flame Resistance:	UL 1666 riser
Electrical Characteristics:	350 MHz, 51.1 dB/100 meters
Manufacturer(s):	Belden 1875GB, Okonite, or approved equal.
Uses Permitted:	Conduit.
Execution:	
Application:	Data Network Communications – Ethernet.
Installation:	Install in accordance with this Section and associated equipment manufacturer's instruction.
Testing:	Test in accordance with this Section.

Cable System Identification: NC3

Description:	Category 6, gigabit Ethernet, 4 pair cable, shielded
Voltage:	300V rms
Conductor Material:	Solid bare copper 23 AWG
Insulation Material:	Polyolefin (PO) + Fluorinated Ethylene Propylene (FEP)
Shield:	Shielded, Polyester + Bi-Laminate (Alum+Poly) 100 percent coverage with solid drain wire
Jacket:	Polyvinyl chloride (PVC), 0.290-inch diameter
Flame Resistance:	UL 1666 riser
Electrical Characteristics:	250 MHz, 22.0 dB/100 meters
Manufacturer(s):	Belden 1351A, Okonite, or approved equal
Uses Permitted:	Conduit.

Execution:

Application:	Data Network Communications – Shielded Ethernet.
Installation:	Install in accordance with this Section and associated equipment manufacturer's instruction.
Testing:	Test in accordance with this Section.

Cable System Identification: IT

Description:	DataTuff Enhanced Category 6, gigabit Ethernet, 100BaseTX, 4 bonded pair cable, non-armored
Voltage:	300V rms, or 600V rms
Conductor Material:	Bare copper 23 AWG solid.
Insulation Material:	Fluorinated Ethylene Propylene (FEP)
Shield:	Unshielded for 300V application, Bi-Laminate (Alum+Poly) 100% shielded for 600V application
Jacket:	Fluorinated Ethylene Propylene (FEP), 0.214-inch diameter for 300V application and 0.335-inch diameter for 600V application.
Flame Resistance:	UL 723, NFPA 262 for 300V application, UL 16666 for 600V application
Electrical Characteristics:	250 MHz, 32.8 dB/100 meters
Manufacturer(s):	Belden 7931A – 300V, Belden 7953A – 600V, or approved equal.
Uses Permitted:	Conduit, Tray, In-cabinet
Execution:	Use 600V for MCC, Motor Control cabinets or other applications in close proximity to 480V circuiting or where “noise” could be an issue.
Application:	Data Network Communications – Ethernet.
Installation:	Install in accordance with this Section and associated equipment manufacturer’s instruction.
Testing:	Test in accordance with this Section.

END OF SECTION

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SECTION 26 05 26 - GROUNDING SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. System Requirements.
5. Sizing.
6. Submittals.
7. Products.
8. Execution.

1.2 SCOPE

A. This section specifies the system for grounding electrical distribution and utilization equipment, including but not limited to cabinets, motor frames, manholes, instrumentation, metal surfaces of process/mechanical equipment that contain energized electrical components, metal structures and buildings, outdoor metal enclosures, fences and gates.

1.3 REFERENCE STANDARDS

A. 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.

B. 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
IEEE 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE Std 81.2-1991	Guide to Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems
NETA - ATS	Inter-National Electrical Testing Association Inc. - Acceptance Testing Specifications
NFPA 70	National Electric Code (NEC) Article 250

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 SYSTEM REQUIREMENTS

A. Provide equipment grounding conductors in all electrical raceways. The conductors shall be sized in accordance with the National Electrical Code.

B. Underground, rebar, and building steel ground connections shall be via exothermic weld or hydraulically die crimped cold weld.

C. Bond building's rebar and building steel attributes to form a ground mat. Bond all site ground mats via exothermic weld or hydraulically die crimped cold weld.

D. Provide cable tray grounding and bonding in accordance with these project specifications and the drawings.

1.6 SIZING

A. SIZING: The minimum size of the Equipment Grounding Conductors installed with the circuit conductors shall be per the National Electrical Code Table 250.122. The circuit grounding conductor size routed with a feeder or branch circuit conductors is as shown on the drawings.

1.7 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Marked product literature for ground rods, test wells, and equipment ground plate.

4. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

   b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

   c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

   d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

5. Grounding system test data.

PART 2 PRODUCTS

2.1 PROCESS EQUIPMENT GROUNDS

A. The CONTRACTOR shall coordinate with the equipment supplier to provide an equipment ground lug and CONTRACTOR provided ground cable and terminations to bond the equipment to the grounding electrode system. Ground cable shall be sized in accordance with this specification. Provide cables, exothermic welds, hydraulic die crimp connections and equipment bolted connections as necessary.

2.2 GROUND CONDUCTORS

A. The System Ground Conductor shall be soft-drawn, bare annealed copper, concentric stranded, as specified. The minimum sizes shall be as follows, where American Wire Gage (AWG) conductor sizes are not shown or specified:

15 kV-5 kV transformers	4/0 AWG
480V switchboards	4/0 AWG
480V MCC	4/0 AWG
ATS and MTS	2/0 AWG
Cable tray	2/0 AWG
Lighting & Power panels	2 AWG
Exposed metal cabinets	2 AWG
Electrical & Process equipment	2 AWG
Buildings and enclosure	2 AWG
Fences and gates	2 AWG
Motors 25 HP to 250 HP	2 AWG
Motors 1 HP to 25 HP	6 AWG

2.3 GROUND RODS

A. Ground rods shall be copper covered steel, 3/4-inch diameter and 10-feet long. Rods shall have threaded type removable caps so that extension rods of same diameter and length may be added where necessary.

2.4 CONNECTORS

A. COMPRESSION CONNECTORS: Compression connections shall be irreversible, cast copper as manufactured by Thomas and Betts, or approved equal.

B. BOLTED CONNECTORS: Bolted connectors shall be Burndy, O. Z. Gedney, Thomas and Betts, or approved equal.

C. EXOTHERMIC WELDED CONNECTORS: Exothermic welding products shall be Erico's Cadweld Plus system with a remotely operated battery powered electronic ignition device and moisture resistant weld metal cup for the required mold, or approved equal.

D. COLD WELDED CONNECTORS: Hydraulically die crimped cold weld connectors shall be cast copper compression cross grid type as manufactured by Burndy, or approved equal.

2.5 TEST WELLS

A. CONCRETE BOXES

1. Material: High density reinforced concrete box with non-settling shoulders positioned to maintain grade and facilitate back filling with steel checker plate screw down cover.

2. Product and Manufacturer: Provide box assembly from one of the following:

a. Concrete Box: Christy Concrete Products, Inc. Model #G05T or Approved Equal.

b. Steel Cover: Christy Concrete Products, Inc. Model #G05CT labeled "GROUND" or Approved Equal.

B. EXTERIOR TEST WELL: Provide concrete test well with cover and connect the ground grid extension using a removable connector.

2.6 EQUIPMENT GROUND BARS

A. Ground bars required in power distribution equipment shall be tin plated copper and sized in accordance with manufacturer's standard.

B. Copper equipment ground bars shall be Erico Eritech EGB Series or approved equal, sized as required for the installation.

C. Ground bars shown in electrical rooms or adjacent to electrical equipment shall be tin plated copper and shall be wall mounted at 18 inches above finished floor on isolation standoffs. Unless otherwise specifically sized, the ground bars shall be 30 inches long, 4 inches tall and ¼ inches thick. Bars shall have pre-drilled 7/16" holes for termination of lugged conductors. Ground bars shall be Storm Copper, Alpha Equipment Company isolated ground bar assembly, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Embedded and buried ground connections shall be made by exothermic or irreversible cold weld connectors. Above grade ground connections shall be made by exothermic weld or by utilizing diamond or hexagon dies and a hand compression tool for wire sizes 2 AWG and smaller and a hydraulic pump and compression head for wire sizes 2/0 AWG and larger. Tools and dies shall be approved for this purpose; dimple compressions are not acceptable. Compression connections shall be prepared in accordance with the manufacturer's instructions. Exposed ground connections to equipment shall be made by bolted clamps unless otherwise specified. No solder shall be used in any part of the ground circuits.

B. Embedded ground cables and fittings shall be exothermically or cold weld bonded to concrete reinforcing steel. Ground wires shall also be securely attached to concrete reinforcing steel with tie wires and prevented from displacement during concrete placement.

C. Grounding conductors, which are extended beyond concrete surfaces for equipment connection, shall be extended a sufficient length to reach the final connection point without splicing. Minimum extension shall be 3 feet. Grounding conductors, which project from a concrete surface, shall be located as close as possible to a corner of the equipment pad, protected by non-metallic conduit, or terminated in a flush grounding plate. Exposed grounding conductors shall be supported by noncorrosive metallic hardware at 4-foot intervals or less. Grounding conductors for future equipment shall be terminated using a two-hole copper flush mounted grounding plate.

D. Ground conductors, except signal conductor shields, entering enclosures shall be bonded together to the enclosure if it is metallic and to metallic raceways within or terminating at the enclosure. Prior to making ground connections or bonds, the metal surface at the point of connection shall be cleaned.

E. Compression-type lugs shall be used in accordance with manufacturer’s recommendations.

F. Grounding conductor shall not be used as a system neutral. Grounding conductor shall not be used as a system neutral.

G. Surge arresters shall be directly connected to the ground system using copper conductors, sized as specified.

H. Metallic sheaths or shields of shielded power cable shall be terminated by a copper grounding strip provided with cable connection for connection to the grounding system. Grounding strip shall be sized to withstand available fault current for specimen to be terminated.

I. Furnish an equipment grounding conductor in all conduit runs sized in accordance with the NEC.

J. Grounding system shall be provided in compliance with the NEC.

K. Metallic sheaths or shields of shielded power cable shall be terminated by a copper grounding strip provided with cable connection for connection to the grounding system.

L. Bond building service piping systems to ground within three feet of entering the building.

3.2 RACEWAY GROUND

A. All service, feeder and branch circuit raceways shall contain a green insulated ground conductor sized per applicable NFPA 70 National Electrical Code (NEC) tables:

1. T250.66 - Grounding Electrode Conductor for Alternating-Current Systems or

2. T250.122 - Minimum Size Equipment Grounding Conductors for Grounding Raceways and Equipment.

B. Metallic conduits terminating at concentric knock-outs or reducing washers shall be bonded using insulated grounding bushings. Grounding bushings shall be connected to the grounding system using conductors sized in compliance with NEC.

C. Provide equipment grounding conductors in all power and control circuit raceways.

3.3 EQUPMENT AND ENCLOSURE BONDING

A. Electrical distribution and utilization equipment enclosure ground bus, motor frames, manholes, metal structures and buildings, outdoor metal enclosures, fences and gates shall be bonded to the grounding system with conductor sizes as specified.

B. Connect the conductor to the metal enclosure using a UL listed connector, where the enclosure does not contain an internal ground bus.

C. Non-electrical equipment with metallic enclosures that are located outdoor, and without a cover or a shade, shall be connected to the grounding system.

3.4 ISOLATED GROUNDING

A. An isolated ground system shall be installed where required by an equipment manufacturer. The isolated ground conductor shall have green insulation with a yellow stripe and shall be run in the same raceway as the power and neutral conductors. The isolated ground bus shall be kept isolated from neutral and grounding buses.

B. Where specifically directed by the OWNER and required by an equipment manufacturer, the CONTRACTOR shall provide an additional isolated ground conductor from the service or separately derived system to an isolated ground bus bar at each associated distribution point.

C. The neutral conductor from the ultra-isolation transformers shall be grounded only at the single point ground bus in the automatic transfer switch.

3.5 SERVICE AND SEPARATELY DERIVED SYSTEM BONDING

A. A neutral bonding jumper shall be installed in only one location for each service or separately derived system. The bonding jumper shall be located at the service source or the first immediate distribution point downstream from the source. The neutral and ground buses shall be kept isolated from each other accept where the bonding jumper is installed.

3.6 GROUNDING SYSTEM TESTS

A. The CONTRACTOR shall test the facility grounding system and the building grounding system to determine the ground resistance. The grounding test shall be IEEE Standard 81 using the NETA Fall-of-Potential procedure. A plot of ground resistance readings for each isolated ground rod, ground mat, or ground bus shall be submitted on 8-1/2 x 11-inch size graph paper. Point-to-point resistance measurements are not acceptable.

1. The current reference rod shall be driven at least 100 feet from the ground rod or grid under test or as recommended by IEEE Standard 81. The measurements shall be made at 10-foot intervals beginning 25 feet from the test electrode and ending 75 feet from it, in direct line between the ground rod or center of grid and the current reference electrode.

2. A grounding system that shows greater than 2-ohm resistance for the flat portion of the plotted data shall be considered inadequately grounded.

3. The CONTRACTOR shall add additional parallel connected ground rods and/or deeper driven rods until the ground resistance measurements meet the 2-ohm requirement. Additional ground rods will be paid for as extra work where the required numbers exceed that specified when authorized and approved by the Construction Manager.

4. Use of salts, water, or compounds to attain the specified ground resistance is not acceptable.

END OF SECTION

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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Execution.

1.2 SCOPE

A. This Section specifies requirements for design, furnishing and installation of support systems for electrical raceways, cables and enclosures.

1.3 REFERENCE STANDARDS

A. 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.

B. 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
ANSI C80.1	Rigid Steel Conduit-Zinc Coated
ANSI C80.3	Electrical Metallic Tubing-Zinc Coated
ASTM A48 REV A	Gray Iron Castings
ASTM F512	Smooth-Wall Polyvinylchloride Conduit and Fittings for Underground Installation
FEDSPEC WW-C-581E	Conduit, Metal, Rigid and Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated
FEDSPEC W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid
NEMA ICS 6	Industrial Control and Systems Enclosures
NEMA TC2	Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)
NEMA TC6	PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA VE1	Cable Tray Systems
NEMA VE 2	Cable Tray Installation Guidelines
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)

Reference	Title
NFPA 70	National Electrical Code (NEC)
NFPA 79	Electrical Standards for Industrial Machinery
UL 1	Flexible Metal Electrical Conduit
UL 6	Rigid Metal Electrical Conduit
UL 360	Liquid Tight Flexible Electrical Conduit
UL 651	Rigid Nonmetal Electrical Conduit
UL 797	Electrical Metallic Tubing

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

4. Supports, seismic bracing, and other electrical system mounting elements are generally not shown on the plan drawings. Hangers, supports, seismic restraints, and other electrical system mounting elements shall be submitted in accordance 01 61 10.

PART 2 PRODUCTS

2.1 RACEWAY SUPPORTS

A. CONDUIT SUPPORTS

1. Framing channel with end caps and straps shall be provided to support groups of conduit. Individual conduit supports shall be one-hole pipe straps used with clamp backs and nesting backs where required. Material as specified herein.

2. Conduit supports for PVC coated rigid steel and PVC conduit systems shall be one-hole PVC coated rigid steel clamps or oversized stainless-steel clamps.

B. CEILING HANGERS: Ceiling hangers shall be adjustable steel rod hangers and fittings. Provide J-Type conduit support for single conduit. Straps or hangers of plumber's perforated tape are not acceptable. Unless otherwise shown, hanger rods shall meet ASTM A193 and be sized as 3/8-inch up to 2-inch conduit and shall be 1/2-inch all-thread rod over 2-inch conduit. Material as specified herein.

C. SUSPENDED RACEWAY SUPPORTS AND RACKS:

1. Suspended raceway supports shall consist of concrete inserts, steel rod hangers, and jamb nuts supporting framing channel or lay-in pipe hangers as required. Framing channel shall be a minimum of 12-gauge. Material as specified herein.

2. Hanger rods shall be a minimum of 1/2-inch diameter all-thread rod and shall meet ASTM A193. Suspended raceway supports and racks shall be braced for seismic forces as specified in 01 61 10.

D. MATERIALS: Table A specifies the type of raceway supports required for each location and application.

Table A

Location	Framing Channel and Accessories	Threaded Rod, Hardware, & Fittings
Indoor Dry	Zinc Plated Steel	Zinc Plated Steel
Indoor, Wet	316 Stainless Steel	316 Stainless Steel
Outdoor	316 Stainless Steel	316 Stainless Steel
Submerged	316 Stainless Steel	316 Stainless Steel
Headspace	Zinc Plated Steel	Zinc Plated Steel
Chemical Corrosive	316 Stainless Steel	316 Stainless Steel
Process Corrosive	316 Stainless Steel	316 Stainless Steel

2.2 EQUIPMENT SUPPORTS

A. Equipment supports shall be installed where shown on the drawings and as required to support the panels and enclosures being installed.

B. Equipment support materials shall adhere to Table A above unless specified otherwise on the drawings.

C. Equipment supports shall be installed per details in the Construction Documents.

2.3 ANCHOR BOLTS

A. Anchor bolts shall be as specified in Section 05 50 00.

PART 3 EXECUTION

3.1 INSTALLATION

A. Hangers and supports shall be installed with spacing between support points in compliance with all applicable codes.

B. The cut ends of support channels shall be smoothed and without burrs left from cutting. For zinc plated steel, seal cut ends with Zinc-it or other sealing bonding means.

END OF SECTION

SECTION 26 05 33 - RACEWAYS, BOXES, AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Installation.
7. Raceway Specification Sheets.

1.2 SCOPE

A. This section covers the furnishing and installation of electrical conduits, wireways, pull boxes, electrical vaults, hand holes, and fittings. Raceways shall be provided for lighting, receptacles, power, control, instrumentation, signaling and grounding systems.

B. NOTE – No reflective materials may be used on the exterior of buildings and structures. Alternatives to devices that would otherwise be Stainless Steel will be required.

1.3 REFERENCE STANDARDS

A. 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.

B. 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
ANSI C80.1	Rigid Steel Conduit-Zinc Coated
ANSI C80.3	Electrical Metallic Tubing-Zinc Coated
ASTM F512	Smooth-Wall Polyvinylchloride Conduit and Fittings for Underground Installation
FEDSPEC WW-C-581E	Conduit, Metal, Rigid and Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated
FEDSPEC W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid
NEMA ICS 6	Industrial Control and Systems Enclosures
NEMA TC2	Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)
NEMA TC6	PVC and ABS Plastic Utilities Duct for Underground Installation

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or material.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

   a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

   b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

   b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

   c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

PART 2 PRODUCTS

2.1 RACEWAY

A. General requirements for raceway materials specified in this section are listed in the RACESPECS sheets at the end of this section. The type of raceway to be used for any given area and application shall conform to the requirements of Table A in this section.

2.2 BOXES AND FITTINGS

A. PULL BOXES AND WIRING GUTTERS: Indoor boxes above grade and in unclassified indoor areas shall be NEMA 12 with hinged doors. Similar enclosures for below grade and outdoors shall be rated NEMA 4X (Type 316 stainless steel) with hinged doors. Boxes in hazardous classified areas shall be rated for the classification, NEMA 7. Box covers shall be provided with hinged doors with quick release latches and oil resistant gaskets. Box and gutter sizes, metal thickness, and grounding shall comply with the National Electrical Code. Bolt-on junction and pull box covers are not allowed.

B. TERMINAL CABINETS: Terminal cabinets located indoors and in unclassified indoor areas shall be NEMA 12. Cabinets located below grade, outdoors, and in corrosive or damp areas shall be NEMA 4X (Type 316 stainless steel). Cabinets in hazardous classified areas shall be rated for the classification, NEMA 7. Cabinets shall be provided with hinged doors with quick release latches. Adjustable terminal strip mounting accessories shall be provided. Cabinets shall be provided with channel mounted terminal blocks rated 30 amperes, 600-volt AC. Terminals shall be No. 8 minimum strap-screw type, suitable for ring tongue or locking spade terminals. Hoffman type CHQR, or approved equal.

C. PULL/JUNCTION BOXES:

1. Indoor boxes above grade and in unclassified indoor areas shall be NEMA 12 with hinged doors. Similar enclosures for below grade and outdoors shall be rated NEMA 4X (Type 316 stainless steel) with hinged doors. Boxes in hazardous classified areas shall be rated for the classification, NEMA 7. Pull and junction boxes for use in raceway systems with conduits 1-1/4" or larger shall be hinged boxes with 2 screw driver operable or quick release latches. Minimum depth of box shall be 5.3", the minimum size shall be as shown on the drawings or as required for the application or NEC. Hoffman type CH or approved equal. For damp, below grade, outdoor, or corrosive applications provide Hoffman type CHFNFSS or approved equal.

2. For Hazardous areas provide Cast copper free aluminum box with neoprene gasketed screw on cover. Crouse-Hinds GUE, GUB, or approved equal.

D. ELECTRICAL VAULTS:

1. Electrical vaults shall be precast concrete with covers designed for H-20 loading. Dimensions shall be as specified on the standard details. Electrical vaults shall be provided with precast solid concrete slab bottoms with sumps as indicated, and a 3 inch by 2-foot-

long copper ground bar. Electrical vaults shall be constructed of 3000 psi reinforced concrete. Manhole covers shall be engraved “ELECTRICAL”, “CONTROL” or “SIGNAL” as applicable.

2. Manhole covers shall be hinged and watertight unless otherwise indicated on the drawings. Hinged covers shall be made of aluminum and provided with a locking latch. Covers shall be made for easy opening and latching and be provided with a mechanism that shall hold the cover in the open position at 90 degrees, and provided with spring-assist openers. Manhole covers shall be bonded to ground bar via flexible copper braid or self-grounding connections.

3. Electrical vaults shall be provided with pulling irons and galvanized cable racks on each wall. Cable racks shall utilize porcelain cable supports. Cable racks shall be installed on spacings of not greater than 36 inches and shall be bolted to permanent wall surfaces with anchors or continuous slot concrete inserts.

4. Electrical vaults shall be per the size indicated in the contract drawings and include a H-20 loading where shown on the drawings. Oldcastle or approved equal.

E. HAND HOLES:

1. Hand holes shall be per the size indicated in the contract drawings and include a H-20 loading where shown on the drawings. Hand holes shall be engraved with “ELECTRICAL”, “CONTROL” or “SIGNAL” as applicable.

2. Unused conduits shall be provided with conduit seal caps.

2.3 RACEWAY SUPPORTS

A. All support systems for electrical systems shall be as specified in Section 26 05 29.

2.4 CONCRETE ENCASED DUCT BANKS

A. Concrete used for duct banks shall be Class E with red oxide added as specified in the Cast-in-Place Concrete section. Rebar shall be as indicated on the drawings.

2.5 UNDERGROUND MARKING TAPE

A. Underground marking tape shall be for early warning protection of digging around reinforced concrete duct banks. Tape shall be low density polyethylene plastic, nominally 6 inches wide and 4 mil thickness. The plastic color shall be red. A warning shall be imprinted continuously along the length, with message reading similar to “CAUTION - STOP DIGGING - BURIED ELECTRIC LINE BELOW.” Tape shall be Brady “Identoline,” Services and Materials “Buried Underground Tape,” Somerset (Thomas & Betts) “Protect-A-Line,” or approved equal.

B. Underground marking tape for directly buried cables and conduits shall be 6-inch wide metallic lined tape with red polyethylene film on top and clear polyethylene film on the bottom. The message shall be clearly printed with black over red tape and shall read “CAUTION ELECTRIC LINE BURIED BELOW.”

2.6 NAMEPLATES

A. Nameplates shall be provided for all pull and junction boxes in accordance with the requirements of Section 26 05 00. Nameplate numbering shall be as indicated on the drawings. Where no wording is specified, the CONTRACTOR shall provide the functional description of the device on the nameplate or as required by the Engineer and OWNER. Any nameplates provided where the wording is not specified shall first be approved by the Engineer and OWNER.

2.7 FIRESTOPS

A. Raceway penetrations through masonry walls shall be mortared to seal penetration's air gaps. Raceways penetrations through other walls shall utilize an approved elastomer product to seal up all air gaps.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Table A specifies the type of raceway required for each location and application by RACESPEC sheet. Unscheduled conduit, (i.e. lighting, convenience outlets, etc.), not shown on the drawings shall be in accordance with Table A below.

Table A

Location	Application/Condition	RACESPEC
Indoor Dry	Exposed	GRS
Indoor Wet	Exposed	PGRS
Outdoor	Exposed	PGRS
Concealed	Power circuits embedded in concrete structure or beneath slab-on-grade	PVC4
Concealed	Instrumentation, communications and data signals encased in concrete, duct bank	PGRS
Underground	Power circuits encased in concrete, duct bank	PVC4
Underground	Power circuits directly buried	PVC4
Underground	Instrumentation, communications and data signals directly buried	PVC4
Nonhazardous	Final connection to equipment and light fixtures	LFS
Hazardous corrosive	Exposed	PGRS
Architecturally finished areas	Final connection to light fixtures	FLEX

3.2 CONDUIT

A. GENERAL:

1. The number of directional changes of a conduit shall be limited to 270 degrees in any run between pull boxes.

2. Conduit runs shall be limited to a maximum of 400 feet, less 100 feet or fraction thereof, for every 90 degrees of change in direction.

3. Provide pull and junction boxes per code. When shown on drawings, box or manhole sizes shall be considered to be minimum sizes and shall be upsized by the CONTRACTOR for ease of pulling wire or if required by NEC.

B. INDOOR AND OUTDOOR CONDUIT SYSTEMS:

1. In general, CONTRACTOR shall be responsible for determining conduit routing that conforms to the specified installation requirements:

   a. Conduits for lighting and outlets: exposed
   b. Conduits for lighting and outlets: concealed
   c. Conduits for process equipment: exposed
   d. Conduit inside structures: exposed
   e. Conduit concealed inside water chambers slabs and walls: not permitted.

2. Existing conduit installations may be utilized provided the installation meets the following requirements:

   a. The installation meets the project specifications.
   b. The raceway meets the minimum National Electrical Code (NEC) requirements.
   c. The raceway is re-labeled per the project raceway schedules.

3. Conduit installation shall conform to the requirements of the RACESPEC sheets and the following specified installation requirements:

   a. Exposed conduit: Install parallel or perpendicular to structural members and surfaces. Install conduit horizontally and allow minimum headroom of 7 feet.

   b. Route two or more exposed conduits in the same general routing parallel with symmetrical bends.

   c. Maintain minimum spacing between exposed parallel conduit and piping runs in accordance with the following when the runs are greater than 30 feet:

      1) Between instrumentation and telecommunication: 1 inch
      2) Between instrumentation and 125 VDC, 48 VDC, and 24 VDC: 2 inches
      3) Between instrumentation and 600 VAC and less power: 6 inches
      4) Between instrumentation and 600 VAC and greater power: 12 inches
      5) Between telecommunication and 125 VDC, 48 VDC, and 24 VDC: 2 inches
      6) Between telecommunication and 600 VAC and less power: 6 inches
      7) Between telecommunication and 600 VAC and greater power: 12 inches
      8) Between 125 VDC, 48 VDC, and 24 VDC and 600 VAC and less power: 2 inches
      9) Between 125 VDC, 48 VDC, and 24 VDC and 600 VAC and greater power: 2 inches
      10) Between 600 VAC and less power and 600 VAC and greater power: 2 inches
      11) Between process, gas, air and water pipes: 6 inches

   d. Space exposed conduit installed on supports not more than 10 feet apart. Space multiple conduits in parallel and use framing channel.

   e. Comply with the requirements of Section 26 05 00 and herein, where conduits are suspended from the ceiling.

f. Secure conduit rack supports to concrete walls and ceilings with cast-in-place anchors or framing channel concrete inserts.

g. Install conduits at least 6 inches from high temperature piping, ducts, and flues with temperatures higher than 90-degree C.

h. Install conduits between the reinforcing steel in walls or slabs that have reinforcing in both faces.

i. Place conduits under the reinforcement in slabs with only a single layer of reinforcing steel. Separation between conduits, conduits and reinforcement, and conduits and surfaces of concrete shall be maintained in accordance with IBC.

j. Route conduit clear of structural openings and indicated future openings.

k. Provide conduits with flashed and watertight seals routed through roofs or metal walls.

l. Grout conduits into openings cut into concrete and masonry structures.

m. Cap conduits or plug flush conduits during construction to prevent entrance of dirt, trash, and water. Cap or plug empty conduits designated as “future”, “spare”, or “empty” and include a pulling line accessible at both ends. Use anti-seize compound on cap and plug threads prior to installation.

n. Determine concealed conduit stub up locations from the manufacturer’s shop drawings. Terminate concealed conduit for future use in specified equipment.

o. Install conduit flush with structural surfaces with galvanized couplings and plugs. Caps and plugs shall match the conduit system.

p. Provide concealed portions of conduits for future equipment where the drawings indicate future equipment. Match the existing installation for duplicate equipment.

q. Terminate conduits that enter enclosures with fittings that match the NEMA rating of the enclosure.

r. Underground metallic or nonmetallic conduit that turn out of concrete, masonry or earth: Install a 90-degree elbow of PVC- coated rigid steel conduit before emergence above ground.

s. Provide O-Z Gedney “Type DX” or Crouse-Hinds “Type XD” bonded, weather-tight expansion and deflection fitting for the conduit size where conduit across structural joints that allows structural movement.

C. UNDERGROUND CONDUIT SYSTEM: Excavation, backfilling, and concrete work shall conform to respective sections of these specifications. Underground conduit shall conform to the following requirements:

1. Underground conduits shall be reinforced concrete encased under roadways or where otherwise exposed to possible damage or where adequate cover does not exist.

2. Concrete encased conduit shall have minimum concrete thicknesses of 2 inches between conduits, 1 inch between conduit and reinforcing, and 3 inches between reinforcing and earth, unless shown otherwise in an electrical detail.

3. Concrete encasement on exposed outdoor conduit risers shall continue to 3 inches above grade, with top crowned and edges chamfered.

4. Underground conduit bend radius shall be not less than 2 feet minimum at vertical risers and shall be not less than 3 feet elsewhere.

5. Where conduit and concrete encasement are terminated underground, the conduit and reinforcing shall both extend at least 2 feet past the concrete. Conduits shall be capped and threads protected. Steel surfaces shall be given two coats of epoxy paint.

6. Underground conduits and conduit banks shall have 2 feet minimum earth cover unless otherwise shown.

7. Underground conduit banks through building walls shall be cast-in-place or installed with concrete into boxouts with water stops on all sides of the boxout. Water-stops shall be as specified in the Cast-in-place Concrete section. Extend the horizontal reinforcement from the duct bank into the boxout terminating with J-hook bends.

8. Conduits not encased in concrete and passing through walls with one side in contact with earth shall be sealed watertight with special rubber gasketed sleeve and joint assemblies or with sleeves and modular rubber sealing elements.

9. Thoroughly swab conduits and raceways on the inside, immediately upon completion of pouring concrete.

10. After the concrete has set and before backfilling, pull a mandrel through each conduit. The mandrel shall have a diameter equal to the nominal conduit inside diameter minus 1/2 inch and shall not be less than 4 inches long.

11. If the mandrel showed signs of protrusions on the inside of the conduit, the conduit shall be repaired or replaced.

12. Provide manufactured plastic conduit spacers anchored to prevent movement during the concrete pour. Manufacture: Carlon, PW Pipe, Underground Devices, or equal.

13. Backfill duct banks with clean fill compacted to 90-percent in 6-inch lifts after concrete has cured. Refer to Section 03 30 00 for concrete requirements including minimum 7 days of cure time prior to backfill over duct banks.

14. Provide PVC threaded adapter with female threads where PVC conduit is joined to steel conduit. Procedure:

    a. Before assembly: Double coat steel conduit with Red-Robroy, Green-Permacote, Blue-Ocal or approved equal product.

    b. After assembly: Seal with 65-mil thick, 2-inch-wide mastic sealing tape to 1/2-inch beyond threads. Products: 3M Scotch 2228; Plymouth 02625; or approved equal.

c. Cover with 20-mil corrosion protection tape applied in 1/2-lap layers to 2-inch beyond threads. Products: 3M Scotchwrap 51; Plymouth Plywrap 12; or approved equal.

15. Provide PVC conduit with bell ends where duct banks terminate at walls, electrical vaults, or hand holes. Install bell ends flush with finished concrete.

16. Provide PVC conduit with bell ends where conduit rise below grade into a floor mounted electrical panel, electrical cabinet, MCC, or switchboard.

17. Separate power conduits from signal conduit within the same duct bank by 12" or greater separation where possible.

18. Separate high voltage duct banks from low voltage duct banks, where shown.

19. Provide wireways for transition from underslab conduits rising into wall- mounted panels where the number of conduits exceed the NEC allowable panel space in the bottom of the panel. Provide conduit sleeves or fitting for panel transition. Continuous thread or all-thread is prohibited.

D. ELECTRICAL VAULTS: Unless otherwise specified, electrical vaults installation shall be as follows:

1. Electrical vaults shall be provided in accordance with the drawings

2. Electrical vaults shall be set on a minimum of 6 inches of crushed rock on top of undisturbed or compacted earth.

3. Electrical vaults shall be set plumb, so that water shall drain properly to the sump.

4. Unless installed within a roadway, manhole pre-cast covers, unless otherwise specified, shall be set at 1 to 2 inches above finish grade with surrounding pavement sloping away from the manhole cover.

5. All metallic hardware inside electrical vaults shall be grounded by connection to the ground plate. Connections shall be made using bolted connections, bonding jumpers and grounding bushings.

6. Electrical vaults shall be supplied with a ground rod in accordance with 26 05 26.

7. Electrical vaults for medium voltage cabling shall require all racked MV cabling in vault to complete a 360 degree wrap around inside of vault before exiting.

E. CONDUIT IN BLOCK WALLS:

1. Install multiple runs of conduit that stub-up into a block wall and connect to recessed electrical panels with adequate space for the conduit. Coordinate the electrical work with the structural work and block installers to provide a chase to install the conduit. Install conduit in the cells that do not contain structural reinforcement. Install conduits in the center of the cell to avoid affecting the structural integrity of the wall.

2. Avoid conduit and electrical boxes installation that blocks the cell from being grouted or that blocks the cell reinforcing bars from being grouted. Avoid conduit in the first cell

adjacent to doors, windows, corners and wall intersections and install conduits in the center of the first available cell a minimum of 1'-0" from the edge of these openings.

3. Where solid grouting of masonry walls is specified, install conduit and electrical boxes so as to provide sufficient space for grout to flow pass the boxes and conduit in order to fully fill the space beneath and behind. Where boxes need to be held in place, secure the boxes from the face of the block wall. Do not place items behind or next to electrical boxes to hold in place.

4. Coordinate split-face, slump and scored block installation with the masonry contractor to supply smooth face block at the location of receptacles and switches so that the device covers install flush to the wall. Install translucent weather-proof sealing material under device covers on outdoor or wet area locations.

F. CONDUIT SEAL-OFF FITTINGS:

1. Conduits passing:

a. Between Class I, Division 1 area and Class I, Division 2 area; provide sealing fittings located at the boundary in accordance with NEC Article- 500.

b. From hazardous or corrosive area into a non-hazardous or non-corrosive area.

c. Install the seal-off material in the conduit seal-off fittings after inspection.

G. CONDUIT SEALING MATERIAL: Provide HYDRA-SEAL® Handi-Polyurethane-Foam or approved equal product to seal conduits and inner ducts.

1. Sealing product required features

a. Compatible with common cable jacket materials.
b. ASTM E-84 flame spread requirements and UL Classified.
c. Pre-pressurized, portable, one-component closed-cell foam sealing system.
d. Dries tack-free within 15 minutes and cures within 24 hours.
e. Reacts with applied moisture or with ambient humidity.
f. Remove over-spray with acetone and remove cured foam mechanically

2. Application Criteria:

a. Apply in ambient temperatures between 60° to 100° F.
b. Apply bead onto clean surface.

3.3 ELECTRICAL VAULTS AND HANDHOLES

A. Unless otherwise specified, manhole and hand hole installation shall be as follows:

1. Electrical vaults shall be provided in accordance with the drawings.

2. Electrical vaults, hand holes, and pull boxes shall be set on a minimum of 6 inches of crushed rock on top of undisturbed or compacted earth.

3. Electrical vaults and hand holes shall be set plumb so that water shall drain to the sump.

4. Manhole covers shall be hinged and flush with the manhole lid. Manhole lids shall be set at 2 inches above finish grade with surrounding pavement sloping away from the manhole cover.

5. Metallic hardware inside electrical vaults and hand holes shall be bonded to the ground plate or ground bus using bolted connections, bonding jumpers and grounding bushings.

6. Electrical vaults shall be supplied with a ground rod in accordance with 26 05 26.

3.4 RACEWAY NUMBERING

A. Each conduit shall be provided with a number tag at each end and in each manhole, hand hole, or pull box.

B. Within electrical vaults, glue raceway tag to manhole wall next to raceway penetration.

3.5 RACEWAY SCHEDULE

A. GENERAL: Raceways are scheduled on the drawings.

B. UNSCHEDULED RACEWAY:

1. With the exception of lighting and receptacle circuits, the type and size of raceway shall be as specified on the drawings or schedules.

2. Unscheduled lighting and receptacle raceways shall be sized by the CONTRACTOR in accordance with the NEC. Minimum size shall be 3/4 inch for exposed and 1 inch for embedded raceway.

3.6 RACESPEC SHEETS

A. The following RACESPECS are included in Paragraph 3.7.

1. FLEX
2. GRS
3. LFS
4. PGRS
5. PVC4

3.7 RACEWAY SPECIFICATION SHEETS (RACESPEC)

A. RACEWAY SPECIFICATION SHEETS (RACESPEC) – FLEX

Raceway Identification	FLEX
Description	Flexible Steel Conduit
Application	Final connection to equipment subject to vibration or adjustment.
Compliance	UL 1
Construction	Spirally wound galvanized steel strip with successive convolutions securely interlocked
Minimum size	½ inch
Fittings	Compression type
Other	FLEX shall be provided with an internal ground wire.

B. RACEWAY SPECIFICATION SHEETS (RACESPEC) – GRS

Raceway Identification	GRS
Description	Galvanized Rigid Steel Conduit (GRS).
Application	Final connection to equipment subject to vibration or adjustment.
Compliance	ANSI and UL
Finish	Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.
Minimum size	Unless otherwise specified, ¾ inch for exposed, 1 inch for embedded, encased, or otherwise inaccessible.
Fittings	
Locknuts, Rings, Hubs	Hot-dip galvanized insulated throat with bonding locknut or ring. The hubs shall utilize a neoprene "O" ring and provide a watertight connection. O-Z Gedney, CHM-XXT, or approved equal.
Unions	Electro-galvanized ferrous alloy type Appleton UNF or UNY, Crouse-Hinds UNF or UNY, or approved equal. Threadless fittings are not acceptable.
Conduit Bodies	40% Oversized conduit bodies (Similar to T&B Form 8): Ferrous alloy type with screw taps for fastening covers to match the conduit system. Gaskets shall be made of neoprene.
Boxes	
Indoor	Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.
Outdoor	Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.
Corrosive	NEMA 4X stainless steel or nonmetallic, as specified.
Hazardous	NEMA Class 7 cast ferrous.
Elbows	
¾ '' thru 1 ½''	Factory fabricated or field bent
2'' thru 6''	Factory fabricated only
Conduit Bodies (Oversized)	
¾ '' thru 4''	Malleable iron, hot-dip galvanized, unless otherwise noted. Neoprene gaskets for all access plates. Tapered threads for conduit entrances

Raceway Identification	GRS
5'' and 6''	Electro-galvanized iron or cast-iron box
Expansion Fittings	Expansion fittings in embedded runs shall be watertight with an internal bonding jumper. The expansion material shall be neoprene allowing for 3/4-inch movement in any direction
Manufacturers	Appleton, Crouse-Hinds, Hubbell, O. Z. Gedney, or approved equal
Installation	Rigid steel conduit shall be made up tight and with conductive thread compound. Joints shall be made with standard couplings or threaded unions. Steel conduit shall be supported away from the structures using hot-dip galvanized malleable iron straps with nesting backs or framing channel. Conduit entering boxes shall be terminated with a threaded hub with a grounding bushing. Exposed male threads on rigid steel conduit shall be coated with zinc-rich paint.

C. RACEWAY SPECIFICATION SHEETS (RACESPEC) - LFS

Raceway Identification	LFS
Description	Liquidtight Flexible Steel Conduit.
Application	Final connection to equipment subject to vibration or adjustment.
Compliance	UL 360.
Construction	Spirally wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight plastic cover.
Minimum size	¾ inch, except for instruments where ½ inch is acceptable.
Fittings	Cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral
	O-ring seals around the conduit and box connection and insulated throat
	Provide forty-five and ninety degree fittings where applicable
	Provide PVC coated flexible conduit and fittings where the conduit system is PVC coated
Installation	Length of flexible liquidtight conduit shall not exceed 36 inches in length. Use conductive thread compound.

D. RACEWAY SPECIFICATION SHEETS (RACESPEC) – PGRS

Raceway Identification	PGRS
Description	Rigid Steel Conduit, Corrosion-Resistant, Polyvinyl Chloride (PVC) Coated. Provide factory made and coated elbows.
Compliance	ANSI and UL. The PVC coated rigid galvanized steel conduit shall meet NEMA RN1-2005 and UL-6 PVC adhesion performance requirements.
Finish	PGRS shall be hot-dip galvanized rigid steel conduit as specified in 26 05 33-7.03 GRS, with a PVC Coating. The PVC coating shall be gray, minimum 40 mils thick, bonded to the outside and continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles, or pinholes. Thread protectors shall be used on the exposed threads of the PVC coated conduit A 2-mil coat of urethane enamel coating shall be bonded to the inside. Coating shall be free of pinholes. Bond strength shall exceed the tensile strength of the PVC coat.
Minimum size	¾ inch
Fittings	Similarly coated to the same thickness as the conduit and provided with Type 316 stainless steel hardware. Conduit and fittings shall be manufactured by the same company Conduit and fittings shall be coated by the same company. Male threads on elbows and nipples, and female threads on fittings or conduit couplings shall be protected by application of urethane coating.
Covers	PVC coated covers shall have a NEMA 4X rating and stainless-steel hardware.
Conduit Bodies	40% Oversized conduit bodies with covers as specified above.
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.
Boxes	
Nonhazardous	Type FD cast ferrous with PVC coating for all device boxes and for junction boxes less than 6 inches square.
Hazardous	NEMA Class 4X stainless steel or nonmetallic for junction boxes 6 inches square and larger.

Manufacturers	Ocal Blue, Robroy Industries, Plasti-Bond, Perma-Cote, KorKap or approved equal.
Installation	Plastic coated conduit shall be made up tight, threaded, and installed using tools approved by the PVC-coated conduit manufacturer. Exposed conduit threads shall be covered by a plastic overlap coated and sealed per manufacturer's recommendations. Pipe wrenches and channel locks shall not be used for tightening plastic coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable. PVC coated conduit shall be supported away from the structure using PVC coated conduit wall hangers or PVC coated conduit mounting hardware. Damaged work shall be replaced.
Training	Installers shall be trained and certified in the proper installation techniques provided by the PVC-coated conduit system manufacture. Proof of certification shall be provided under paragraph 26 05 33

E. RACEWAY SPECIFICATION SHEETS (RACESPEC) – PVC4

Raceway Identification	PVC4
Description	Rigid Nonmetallic Conduit.
Application	Heavy wall thickness for direct bury, concrete encasement or surface mounting where not subject to physical damage.
Compliance	NEMA TC2, UL 651
Construction	Schedule 40, high-impact, polyvinylchloride (PVC).
Minimum size	¾ inch exposed; 1 inch embedded or encased
Fittings	PVC solvent weld type.
Boxes	
Indoor	NEMA Class 4, nonmetallic
Outdoor and corrosive	NEMA Class 4X stainless steel or nonmetallic for junction boxes 6 inches square and larger.
Manufacturers	NEMA Class 4X, nonmetallic
Installation	PVC conduit entering fiberglass boxes or cabinets shall be secured by threaded bushings on the interior of the box and shall be terminated with a threaded male terminal adapter having a neoprene O ring. Joints shall be made with standard PVC couplings. PVC conduit shall have bell ends where terminated at walls and boxes.

F. RACEWAY SPECIFICATION SHEETS (RACESPEC) - WW

Raceway Identification	WW
Description	Wireway and Auxiliary Gutter: Match the conduit or raceway system specified and shown on the drawings. Minimum: Flanged, oil-tight type with hinged covers
Application	As shown on the drawings.
Compliance	JIC EMP-1
Finish	NEMA-1 and NEMA-12: Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces. NEMA 4X: Type 316 Stainless Steel. Smooth finished surfaces.
Sizes as shown	4 in x 4 in, 6 in x 6 in, 8 in x 8 in
Fittings	PVC solvent weld type.
Indoor non-corrosive area	NEMA-1, NEMA-12 or as shown on the drawings.
Outdoor and corrosive area	NEMA-4X or as shown on the drawings.

END OF SECTION

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Definitions.
5. Submittals.
6. Coordination.
7. Safety Requirements.
8. Delivery Storage and Handling.
9. Products.
10. Execution.

1.2 SCOPE

A. This section includes the requirements for trenching, backfilling and installation of underground ducts and ductbanks, and the design, fabrication, delivery and installation of pull boxes, handholes, manholes and vaults. The extent and location of "Underground Ducts and Raceways for Electrical Systems" Work is shown in the Contract Documents.

1.3 REFERENCE STANDARDS

A. ASTM (American Society for Testing and Materials)
B. NFPA 70 (National Fire Protection Association) - National Electrical Code

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 DEFINITIONS

A. Duct: Electrical conduit and other raceway, either metallic or nonmetallic, used underground, embedded in earth or concrete.

B. Ductbank: 2 or more conduits or other raceway installed underground in the same trench or concrete envelope.

C. Handhole/Pull Box: An underground structure provided with an open or closed bottom, and sized to allow personnel to reach into, but not enter, for the purpose of installing, operating or maintaining equipment or wiring or both.

D. Manhole: An underground utility structure, large enough for a person to enter, with facilities for installing, operating and maintaining submersible equipment and cables.

E. Vault: An underground structurally solid utility structure including all sides, top and bottom, where entry is limited to personal qualified to install, maintain, operate or inspect the equipment or cable enclosed. The enclosure may have openings for ventilation, personnel access, cable entrance, and other openings required for operation of equipment in the vault.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. Submit materials data in accordance with of Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.

C. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the

appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

D. Submittals shall include the following:

1. Product Data:

a. Duct-bank separators and components
b. Ducts, and accessories including elbows, end bells, bends, fittings and solvent cement
c. Vault, Manholes, Handholes, Pull Boxes and accessories
d. Warning tape and planks

2. Shop drawings:

a. Precast or Factory-Fabricated Underground Utility Structures:

1) Dimensioned plans, elevations, sections, details, attachments to other work, and accessories.

2) Duct entry provisions, including locations and duct sizes.

3) Reinforcement details.

4) Frame and cover design and manhole frame support rings.

5) Ladder details.

6) Grounding details.

7) Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.

b. Factory-Fabricated Handholes, and Pull Boxes Other than Precast Concrete:

1) Dimensioned plans, sections, and elevations, and fabrication and installation details.

2) Duct entry provisions, including locations and duct sizes.

3) Frame and Cover design.

4) Grounding details.

5) Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

6) Details, technical data and design calculations for frames and covers.

3. Quality Assurance and Testing:

    a. Qualification data and test results from tests specified in “Quality Assurance” Article. Provide all information specified.

4. Duct-Bank Coordination Drawings as specified in “Coordination” Article.

5. Certificate for concrete and steel used in underground precast concrete utility structures, according to ASTM C 858.

6. Qualification Data: For Professional Engineer and testing agency responsible for testing nonconcrete handholes and boxes.

7. Inspection report for factory inspections, according to ASTM C 1037.

8. Record Documents: Show dimensioned locations of underground ducts, handholes, and manholes from nearest building or permanent structure.

1.7 COORDINATION

A. Show duct profiles and coordination with other utilities and underground structures. Include plans and sections, drawn to scale and show bends and locations of expansion fittings. Revise locations and elevations from those indicated as required to suit field conditions and ensure that duct runs drain to manholes and handholes. Coordinate layout and installation of ducts, manholes, and handholes with final arrangement of other utilities as determined by field verification. CONTRACTOR shall coordinate all modifications with the Engineer prior to final installation.

1.8 SAFETY REQUIREMENTS

A. Comply with safety and protection requirements of Section 26 05 00 - Electrical Work – General.

B. Perform Work in accordance with the safety requirements of the Department of Labor Occupational Safety and Health Administration, Volume 36, Number 75, Part II, Subpart P, “Excavations, Trenching, and Shoring,” and with Section 7 of the Manual of Accident Prevention in Construction as published by the Association General Contractors of America, Inc.

C. Educate supervisors and employees on safety requirements and practices to be followed during the course of the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete units at site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Precast concrete handholes and pull boxes:

a. Utility Vault/Oldcastle Precast Group.
b. Utility Concrete Products, LLC.
c. Concast.
d. Or Approved Equal.

2. Fiberglass Handholes and Boxes:

a. Carson Industries LLC.
b. Christy Concrete Products.
c. Oldcastle Precast.
d. Quazite: Hubbell Power System, Inc.
e. Or Approved Equal.

3. Precast Manholes and Vaults:

a. Utility Vault / Oldcastle Precast Company.
b. Shaw PIPE; Division of Shawcor Co.
c. American Concrete.
d. American Concrete.
e. Or Approved Equal.

4. Duct Sealing Compound:

a. Polywater.
b. Filoform.
c. Or Approved Equal.

2.2 CONDUIT AND DUCTS

A. Metallic Conduit:

1. Galvanized Rigid Steel Conduit (GRC): ANSI C80.1

2. PVC-Coated Rigid Steel Conduit: ANSI RN 1. Coating thickness shall be 0.040 inch, minimum.

B. Nonmetallic conduit: Use underground only for medium-voltage and low-voltage applications

1. Rigid Plastic Conduit: NEMA TC 2, UL 651A, Schedule 40 and Schedule 80 PVC, rated for use with 90°C conductors under all installation conditions and labeled for underground use.

2. Liquid-Tight Flexible Nonmetallic Conduit (LFNC): UL 1660.

C. Conduit Fittings:

1. Steel Fittings: Zinc-coated, cast malleable, ferrous metal, threaded fittings, with neoprene cover gasket on each fitting installed outdoors.

2. PVC Conduit and Tubing Fittings: NEMA TC 3. Provide PVC fittings for PVC conduit and suitable watertight connections where PVC conduit connects to galvanized steel conduit.

3. Seal Bushings: O.Z. compound bushing on each conduit entering a building from outside underground and on each conduit passing from one space into another, which is normally at a lower temperature.

4. Hubs: Appleton "Hub" or "Hub-U" series, Thomas & Betts "370" series, Or Approved Equal hub on each conduit terminating in a box where a hub was not previously provided.

5. Unions: Appleton Type "EC", Thomas & Betts "Erickson Coupling" conduit unions, Or Approved Equal where necessary.

2.3 DUCT SUPPORT/SPACERS

A. Rigid PVC spacers selected to provide [3 1/2"] minimum duct spacings and concrete cover depths indicated, while supporting ducts during concrete pour. Refer to drawing details for additional duct spacing requirements.

2.4 PRECAST CONCRETE HANDHOLES AND PULL BOXES

A. Comply with ASTM C 858 for design and manufacturing processes.

B. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom. Walls and bottom shall be constructed to support rating of cover. Frame and cover shall form top of enclosure.

1. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

a. Type and size shall match fittings to duct or conduit to be terminated.

b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

3. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

4. Drain hole in base, 2-inch minimum diameter.

2.5 HANDHOLES AND PULL BOXES OTHER THAN PRECAST CONCRETE

A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

1. Color: Gray.

2. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.

3. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

4. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

5. Drain hole in base, 2-inch minimum diameter.

B. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers made of reinforced concrete or cast iron.

C. Street Lighting: Reinforced plastic mortar designed and tested to temperatures of - 50°F meeting ASTM D635-91 flammability test.

2.6 PRE-CAST MANHOLES AND VAULTS (AASHTO RATED)

A. Precast Concrete Units: Interlocking, mating sections complete with accessory items, hardware, and features as indicated on Drawings. Shall be capable of supporting designed loads that are expected at the installed location. Walls and floors shall be reinforced to support rated strength of covers. Include concrete knockout panels 1-1/2 to 2 inches thick for future conduit entrances and sleeves for ground rods.

B. Design structure according to ASTM C 858.

C. Structural Design Loading: See structural for loading information.

D. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

1. Type and size shall match fittings to duct or conduit to be terminated.

2. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

E. Ground Rod Sleeve: Provide a 3-inch PVC conduit sleeves in manhole floors 2 inches from the wall adjacent to, but not underneath, the duct routed from the facility.

F. Joint Sealant: Continuous extrusion of asphaltic butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand the maximum hydrostatic pressures at the installation location with the ground water level at grade.

G. Source Quality Control: Inspect structures according to ASTM C 1037. Units shall be capable of supporting specified loads.

H. Drainage:

1. Provide two holes for drainage, two-inch minimum diameter, and provide at least two feet of gravel under manhole.

2.7 CAST-IN-PLACE MANHOLES AND VAULTS

A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod. Structures shall be reinforced to support designed loads that are expected at the installed location. Manhole walls and floors shall be reinforced to support rated strength of cover.

B. Structural design loading for H20.

C. Drainage:

1. Provide two holes for drainage, two-inch minimum diameter, and provide at least two feet of gravel under manhole.

2.8 FRAMES AND COVERS

A. Handhole and Pull Box Covers:

1. Uncoated gray iron meeting ASTM A48, Class 35B or ductile iron meeting ASTM A536 Class 70-50-05 or 80-55-06.

2. Reinforced concrete or weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

a. Frame and Cover shall be capable of supporting designed loads see Structural for loading information.

3. Cover:

a. Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

b. Cover Handle: Recessed.

c. Cover Hinges: Concealed, with hold-open ratchet assembly.

d. Cover to include insert of other devices to facilitate lifting.

e. Cover secured by tamper-resistant locking devices similar to REA or FARGO.

f. Machine cover-to-frame bearing surfaces.

g. Cast-in legend “ELECTRICAL”, “COMM” or “LIGHTING” as appropriate. Concealed hinges, with hold-open ratchet assembly.

h. Legend: Molded lettering, as indicated for each service.

B. Manholes and Vaults

1. Frames, Covers and Ring Components: Comply with structural design loading specified for manholes and vaults. See Structural for loading information.

2. Frame and Cover: Reinforced concrete or [uncoated gray iron meeting ASTM A48, Class 35B] or [ductile iron meeting ASTM A536 Class 70-50-05 or 80-55-06] capable of supporting designed loads.

a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

b. Provide lifting points on manhole covers.

c. Cover Legend:

1) Manhole ID welded on to cover.

a) For electrical power manholes, identification shall be “ELECTRICAL #” where # is the manhole number.

b) For telecom manholes, identification shall be “COMM #” where # is the manhole number.

3. Manhole Ring Components: Precast concrete rings with dimensions and strength matched to those of highway rated roof opening.

a. Mortar for Ring and Frame and Cover Joints: Strength to match rated cover.

b. Where required, seal joints watertight using preformed plastic or rubber conforming to ASTM C 990. Install sealing material according to the sealant manufacturers' printed instructions.

2.9 ACCESSORIES

A. Manhole and Vault Lifting Means

1. Pulling Eyes in Walls: Eyebolt with reinforcing bar fastening insert. 2-inch diameter eye, 1-inch by 4-inch bolt. Working load with 6-inch embedment in 4000 psi concrete: 13,000 pounds minimum tension.

2. Pulling and Lifting Irons in Floor: 7/8-inch-diameter, hot-dipped galvanized, bent steel rod, stress relieved after forming, and fastened to reinforced rod. Exposed triangular opening. Ultimate yield strength: 40,000 pounds shear and 60,000 pounds tension.

B. Bolting Inserts for Cable Stanchions: Threaded precast channel inserts of hot-dipped galvanized or stainless steel; 3’-0” on center; 1/2-inch internal diameter by 2-3/4 inches deep, flared to 1-1/4-inch minimum at base. Tested ultimate pull-out strength: 12,000 pounds minimum.

C. Expansion Anchors for Installation After Concrete is Cast: Per section 05 05 19 – Post-installed Concrete Anchors. Zinc-plated carbon steel wedge type with stainless-steel expander clip, 1/2-

inch bolt size, 5300-pound rated pull-out strength, and 6800-pound rated shear strength minimum. Cast in-place inserts not allowed unless cast by vault manufacturer.

D. Cable Rack Assemblies – heavy duty non-metallic 50% glass reinforced nylon or other non-metallic material having equal mechanical strength, thermal resistance, chemical resistance, dielectric strength and physical properties.

1. Cable Stanchions: Nominal 36 inches high by 4 inches wide, with multiple arm mounting holes and recessed bolt mounting holes.

2. Cable Arms: Arranged for secure drop in attachment in horizontal position at any location on cable stanchion, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450 lb. minimum capacity to 20 inches with 250 lb. minimum capacity. Top of arm shall be nominally 4 inches wide and shall have slots along full length for cable ties.

E. Cable Support Insulators: High glaze, wet-process porcelain arranged for mounting on cable arms.

F. Floor Grate: 1” thick PVC or HDPE Grate approximately the size of the floor.

G. Grounding: Ground per Section 26 05 26 – Grounding.

1. Ground Rods: Ensure rods are copper bonded 3/4-inch by 10-foot minimum.

2. Ground Rod Knock Out: 3-inch knock out for installation of ground rod.

3. Ground Rod Sleeves: 3-inch PVC conduit sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.

4. Ground Wire: Stranded bare copper, #2 AWG minimum.

5. Ground connections shall be compression type connectors, bolted and clamped type.

H. Duct Sealing Compound: Non-hardening, re-enterable, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35°F. Capable of withstanding temperature of 300°F without slump, capable of withstanding minimum 22’ of water, and chemically resistant to gasoline, oils, acids and bases. Adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and the common metals.

I. Mechanical Link Seals: for conduit entering vaults or buildings.

2.10 DUCTBACK CONCRETE

A. Material: Provide in accordance with Section 03 30 00 - Cast-in-Place Concrete and as follows:

1. Gravel: 3/8” maximum.

2. Slump: 4” maximum.

3. Compressive strength: 3,000 psi at 28 days.

4. Color: Dye ductbank concrete red.

5. Reinforcing (except when GRC is used): Steel conforming to ASTM A15. Provide #4 rebar top and bottom, 2'-0" lap at splices (4 places minimum) and #4 @ 18" on center around perimeter with 3" minimum cover.

2.11 BACKFILL MATERIAL

A. Lower Trench Portion (surrounding ductbank): Sandy silt, clay silt, sand clay or other material free of stones and conglomerates larger than 2"

B. Upper Trench Portion (one foot above ductbank up to grade): On-site backfill material consisting of rock, soil or soil-rock mixture containing no rocks or lumps over 6"

C. Controlled density fill (CDF)

1. CDF shall be a mixture of Portland cement, fly ash, aggregates, water and admixtures proportioned to provide a non-segregating, self-consolidating and free flowing material which will result in a hardened, dense, non-settling and excavatable fill. CDF shall be batched to provide a flowing, non-segregating mix with a slump between 6" and 8".

2. CDF shall be used as fill above utilities wherever non-settling backfill is required.

D. Select Native Fill: Unsaturated excavated earth free of rocks, broken concrete and debris 6" and larger, and compacted in 12" lifts to prevent settlement.

E. Reinforced Concrete Ductbanks:

1. Below Concrete Encasement: 6" minimum compacted 5/8" minus crushed rock.

2. Above Concrete Encasement: 3" minimum sand.

3. Upper Trench:

a. Areas Under Pavement: Controlled Density Fill.
b. Areas Not Under Pavement: Select Native Fill.

F. Direct-Burial Conduit

1. Initial Bedding: 3" of sand below conduits.

2. Secondary Bedding: Unsaturated excavated earth free of rocks, broken concrete and debris 2" and larger, and compacted to 6" minimum above conduits.

3. Upper Trench:

a. Areas Under Pavement: Controlled Density Fill.
b. Areas Not Under Pavement: Select Native Fill.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine site to receive ducts and manholes for compliance with installation tolerances and other conditions affecting performance of the underground ducts and manholes. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Existing Utilities: Locate all existing utilities in the area prior to performing any excavation.

C. Existing manholes and handholes within the construction zones shall be provided with a ¾" steel plate cover to maintain protections of the manhole lids and covers. This includes, but is not limited, to construction areas, staging areas, and haul routes.

3.2 EARTHWORK

A. Comply with OSHA/WISHA safety standards for trenching, including stable slope and shoring requirements.

B. Depth: Refer to Drawings for trench depth requirements. Correct points of over-excavation using mechanically-compacted backfill to form a smooth trench bottom. Minimum cover according to NEC or Port Standards whichever is more stringent.

C. Width: Excavate to minimum width consistent with stability of sides.

D. Slope: Slope trenches so that conduit and ducts drain toward manholes and handholes and away from buildings and equipment.

E. Rock Excavation: Where rock pad is used for conduit trench, overexcavate 6" below the ductbanks and refill and compact with selected backfill material of same composition.

F. Muck Excavation: Where muck or unstable material is encountered, over-excavate and backfill to attain proper grade with coarse sand, gravel, or Controlled Density Fill.

1. Stockpile backfill material in an orderly manner; a sufficient distance from the trench to avoid overloading trench banks.

G. Bedding: The entire bottom of the excavation is to be firm, stable, and at uniform density.

H. Excavating for Manholes, Vaults Handholes, and Pullboxes: Provide 12" minimum clearance between outer surfaces of unit and embankment or timber used for shoring.

3.3 CONDUIT AND DUCT INSTALLATION

A. Refer to Specifications and Drawings for conduit and duct materials. Where not specified otherwise, use metallic conduit above and underground.

B. Metallic Conduit: Only use as specified in Section 26 05 33 - Raceways and Boxes.

C. Nonmetallic conduit: Use underground only.

1. Underground in Reinforced, Concrete-Encased Ductbanks: For medium-voltage low-voltage and communication applications. Use Schedule 40 Rigid Plastic Conduit as

standard. Use rigid steel conduit on turns 45° or greater. Use Schedule 80 Rigid Plastic Conduit under roadways and in runway areas.

2. Underground Direct-Burial: For low-voltage applications only. Provide rigid plastic conduit, NEMA TC 2, Schedule 40 PVC (except rigid steel under roadways and either rigid steel or Schedule 80 in runway areas), with NEMA TC3 PVC conduit and tubing fittings.

D. Use PVC fittings for PVC conduit and suitable water-tight connections where PVC conduit connects to galvanized steel conduit.

E. Install conduit and ducts as indicated on Drawings and according to manufacturer's written instructions.

F. Slope: For ductbanks and conduits without profiles, pitch ducts a minimum slope of 0.5% to drain toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between 2 manholes to drain in both directions. For ductbanks with profiles, install the ductbank at the elevation as shown on the drawings.

G. Curves and Bends: For all conduit systems (medium-voltage, low-voltage and communication) use manufactured galvanized rigid steel elbows for stub-ups at equipment and at building entrances with a minimum radius of 36 inches. Where existing conditions may cause 36-inch sweeps to be exposed, 24 inch sweeps may be used with approval of the Engineer. Use manufactured long sweep bends with a minimum radius of 25 feet both horizontally and vertically at other locations. Do not exceed 20 degrees for field bends.

H. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

I. Duct Entrances to Manholes and Handholes: Space end bells approximately 10 inches on center for 5-inch ducts and varied proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrances. Core drill entrances where knockouts do not exist.

J. Under Slab: Use PVC conduit with and suitable water-tight connections. Use rigid steel sweeps and specified elsewhere in this section and transition to rigid at least 24" before stubbing up through concrete floors in all areas, exposed or within electrical equipment.

1. Conduits stubbing up inside of electrical equipment and terminating there may use PVC with the approval of the Engineer

K. Building Entrances: Transition from underground duct to rigid steel conduit 5 feet minimum outside the building wall. Use fittings manufactured for the purpose. Follow appropriate installation instructions below:

1. Concrete-Encased Ducts: Install reinforcing in ductbanks passing through disturbed earth near buildings and other excavations. Provide ductbank support at wall without reducing structural or watertight integrity of building wall.

2. Direct-Buried, Non-encased Duct Entering Non-waterproofed Walls: Provide a Schedule 40 galvanized-steel pipe sleeve for each duct. Caulk space between the conduit and sleeve with duct-sealing compound on both sides for moisture-tight seal.

3. Waterproofed Wall and Floor Entrances: Provide a watertight entrance-sealing device with the sealing gland assembly on the inside. Anchor device into masonry construction with one or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.

L. Separation Between Direct-Buried, Non-Encased Ducts: Provide 3 inches minimum separation for like services, and 12 inches minimum between power and communication ducts.

M. Concrete-Encased Nonmetallic Ducts: Support on plastic separators coordinated with duct size and required duct spacing, and install according to the following:

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts or at 8 feet maximum, and secure separators to the earth and to ducts to prevent floating during concreting. Do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

2. Concrete: Do not pour concrete until conduit installation has been approved. Spade concrete carefully during pours to prevent voids under and between conduits and at the exterior surface of the envelope. Do not use power-driven agitating equipment unless specifically designed for duct bank application. Pour each ductbank between manholes or other terminations in one continuous operation. When more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into the concrete on both sides of the joint near the corners of the envelope.

3. Reinforcing: Reinforce ductbanks where they cross disturbed earth and where indicated on Drawings.

4. Forms: Use the walls of the trench to form the side walls of the duct bank where the soil is self-supporting and the concrete envelope can be poured without soil inclusions; otherwise, use forms.

5. Minimum Clearances Between Ducts: 3 inches between ducts and exterior envelope wall, 3 inches between ducts for like services, and 12 inches between power and communication ducts.

6. Depth: Except as otherwise indicated in the contract drawings, install top of duct bank at least 24 inches below finished grade in non-traffic areas and at least 24 inches below finished grade in vehicular traffic areas.

N. Stub-Ups: Use rigid steel conduit for stub-ups through concrete to equipment. Install insulated grounding bushings at the conduit terminations. For equipment mounted on outdoor concrete pads, extend steel conduit a minimum of 2 feet beyond the edge of the pad. Couple steel conduits to the ducts with adapters designed for the purpose and then encase the coupling with 3 inches of concrete.

O. Sealing: Provide temporary closure at all duct terminations in manholes and vaults installed in this Project. Use sealing compound and plugs to withstand a minimum of 15 psi hydrostatic pressure.

P. Pulling Cord: Install 100-pound- test nylon cord in installed ducts, including spares.

Q. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of ductbank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.4 BACKFILLING

A. Backfill only after all necessary inspections and tests have been performed.

B. Remove all debris, rocks, broken concrete, and formwork before backfilling trenches.

C. Use Controlled Density Fill under pavement areas or wherever non-settling backfill is required.

D. Deposit backfill in layers with materials described in Article "Backfill Material." Uniformly spread and compact backfill with suitable power tampers to the density of the adjacent soil and in such a manner so as not to disturb the alignment of the conduit. If settlement occurs, refill, compact and smooth off to conform to the surface of the ground.

E. Restore surface features at areas disturbed by excavation, and reestablish original grades.

1. Replace removed sod as soon as possible after backfilling is completed.

2. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other Work.

3. Restore vegetation and provide necessary topsoil, fertilizer, lime, seed, sod, sprigging, or mulching.

4. Replace disturbed paving.

3.5 VAULT, MANHOLE HANDHOLE AND PULL BOX INSTALLATION

A. Install as indicated on Drawings according to manufacturer's written instructions and ASTM C 891.

1. In areas which are subjected to vehicular traffic, install units' plumb and level and with orientation and depth coordinated with arrangement of connecting ducts to minimize bends and deflections required for proper entrances.

2. In areas which are not subject to vehicular traffic, install so that manhole lid is 2" above surrounding dirt or gravel, and with orientation and depth coordinated with arrangement of connecting ducts to minimize bends and deflections required for proper entrances.

3. Support units on a level bed of crushed stone or gravel, graded from the 1/2-inch sieve to the No. 4 sieve and compacted to the same density as the adjacent undisturbed earth.

4. Drainage: Where manholes have drain holes in the bottom, provide two feet minimum of gravel below the drain hole or provide a drain line to the nearest storm drain.

B. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cable and conductors and as indicated on Drawings. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

1. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches for field-installed anchor bolts. Use a minimum of 2 anchors for each cable stanchion.

C. Train cables neatly around corners and secure to walls or ceiling using cable clamps with expansion anchors.

D. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

E. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring, encircling and in contact with enclosure, and with top surface secured to top of box cover frame. Bottom of ring shall rest on controlled density fill per Engineer of record.

1. Concrete: 3000 psi, 28-day strength with a troweled finish.
2. Dimensions: Minimum 10 inches wide by 12 inches deep or per Engineer of record.

3.6 GROUNDING

A. Ground underground ducts and utility structures according to Section 26 05 26 Grounding.

1. Handhole: Install two ground rods through floor in each medium voltage handhole and small manhole with top protruding 4” above floor.

2. Manholes and Vaults: Install four ground rods through floor in each medium voltage manhole with top protruding 4” above floor.

3. Ensure rods are copper 3/4 inch by 10 foot minimum.

4. Provide #4/0 ground wire in medium voltage ductbank.

5. Provide #4/0 bare copper ground wire in manhole, attached to wall, attached at 24 inches on center and mounted minimum 6 inches above floor.

6. Provide #2 stranded copper equipment ground minimum in each raceway in use.

3.7 IDENTIFICATION

A. Identify raceways, cables and equipment as specified in Section 26 05 53 - Electrical Identification.

3.8 TESTING AND CLEANING

A. Pull brush through full length of ducts. Use round bristle brush with a diameter 1/2-inch greater than internal diameter of duct. Clean internal surfaces of vaults, manholes and handholes, including sump.

B. Duct Integrity: Swab out ducts with a mandrel 1/2 inch smaller in diameter than internal diameter of ducts.

C. Grounding: Test manhole grounding to ensure electrical continuity of bonding and grounding connections. Measure ground resistance at each ground rod and report results. Use an instrument specifically designed for ground-resistance measurements.

END OF SECTION

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SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Coordination.
6. Products.
7. Execution.

1.2 SCOPE

A. This section includes identification of electrical materials, equipment, and installations. The extent and location of "Electrical Identification" Work is shown in the Contract Documents.

1.3 REFERENCE STANDARDS

A. NFPA 70E National Electrical Safety Code
B. NFPA 70 National Electrical Code
C. ANSI A13.1.,
D. ANSI Z535.4
E. 29 CFR 1910.144
F. 29 CFR 1910.145.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

    d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

C. Submittals shall include the following.

1. Product Data for each type of product specified.
2. Schedule of identification nomenclature to be used for identification signs and labels.

1.6 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 LABEL TYPES

A. Manufacturer's standard products with colors prescribed by ANSI A13.1, NFPA 70, and these Specifications. Only temporary markings that are removable without damaging finish are permitted on equipment.

1. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Install labels and nameplates parallel to equipment lines. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

2. Provide engraved laminated phenolic plastic or melamine label for equipment as noted below. Securely attach engraved labels with blunt end, self-tapping stainless-steel screws with blunt ends. Sheet metal screws are not allowed. Provide white letters on black background for normal power, white letters on red background for emergency power.

a. Provide 5/8-inch minimum height letters on the following equipment:

1) Panelboards, provide labels and warning signs. Secure nameplates to inside surface of door where panel is recessed in finished locations.

2) Switchboards/distribution centers, motor control centers and power centers, pad mounted transformers

3) Secondary feeder breakers in distribution equipment

4) Automatic and manual transfer switches. Labels shall include both normal and emergency source and load.

5) Special equipment housed in cabinets, on outside door.

6) Terminal junction boxes and data gathering panels

7) Cable trays.

8) UPS equipment

b. Provide 1/4-inch minimum height letters on the following equipment:

1) Disconnects and starters for motors on fixed appliances and starters in MCCs

2) Motor controllers and VFDs.

3) Enclosed switches and circuit breakers

4) Low voltage transformers

5) Feeder circuit breakers in switchboards, switchgear, and distribution panelboards. Circuit breakers shall be labeled with destination panel name or load.

6) Duplex receptacles (self-adhesive labels indicating panel and circuit number)

7) Local control panels

8) Raceways and junction boxes

9) Instrumentation Labels

c. Refer to table and descriptions in subparagraphs below for acceptable labeling procedure:

Section	Title	Label Types														
		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
26 05 26	Grounding			⅝		X										
26 05 23	Control/Signal Transmission Media	X	X												X	
26 05 19	600-Volt or Less Wire and Cable	X	X			X									X	
26 05 13	Medium-Voltage Cables						X								X	
26 05 33	Raceways and Boxes															X
26 05 43	Underground Ducts and Manholes						X		X	X	X	X			X	
26 27 16	Cabinets and Enclosures			⅜												
26 05 36	Cable Trays			⅜							X	X				
26 27 26	Wiring Devices				¼											
no section	Electrical Power Monitoring and Control			⅜												
26 32 29	Rotary 400 HZ Converters			½							X					
26 32 13	Engine Generators			⅝							X					
26 33 53	Static Uninterruptible Power Supplies			⅝							X					
26 29 23	Variable Frequency Controllers			⅝							X					
26 12 00	Medium-Voltage Transformers			⅝							X		X			
26 35 33	Low-Voltage Power Factor Correction Capacitors			⅜	X								X			
26 13 00	Medium-Voltage Load Interrupter Switchgear			⅝							X		X			
26 13 26	Medium-Voltage Metal-Clad Drawout Circuit Breaker Switchgear			⅝							X		X			
26 18 39	Medium-Voltage Motor Controllers			⅝							X		X			
26 13 19	Medium-Voltage Pad-Mounted Vacuum Interrupter Switchgear			⅝							X		X			
26 11 16	Secondary Unit Substations			⅝												
26 28 16	Enclosed Switches and Circuit Breakers			⅝												
26 36 00	Transfer Switches			⅝												
26 23 00	Low-Voltage Switchgear			⅝												
26 24 13	Low-Voltage Switchboards			⅝												
26 09 26	Panelboards			½												
26 24 19	Motor-Control Centers			⅝												
26 29 13	Motor Controllers			⅜												
26 25 00	Low-Voltage Busway			⅜								X	X			
26 22 00	Dry-Type Transformers (600-Volt and Less)			½												
26 28 13	Fuses				X											
26 43 13	Transient Voltage Suppression			⅜												
26 51 00	Interior Lighting				X											
26 56 00	Exterior Lighting															

Section	Title	Label Types														
26 09 23	Lighting Controls			½												
28 31 00	Fire Alarm			½												
26 08 00	Acceptance Testing												X			

B. Heat-shrink preprinted tubes, flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200-degree F. Comply with UL 224.

C. Preprinted, flexible, self-adhesive vinyl label laminated with a clear weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

D. Engraved melamine plastic laminate flat stock, 1/16-inch minimum thickness for sizes up to 15 square inches. Use 1/8-inch minimum for sizes larger than 15 square inches. Black with white letters for normal power systems and red with white letters for emergency power systems, with height as shown in table above unless specified otherwise. UV-inhibited when used outdoors. Secure with stainless steel drive screws, stainless steel self-tapping screws or stainless-steel oval-head 6-32 screws tapped into enclosure, or with stainless steel bolts with elastic stopnut.

E. Adhesive-backed plastic machine-printed labels, white with black letters. Indicate panel name and circuit number(s).

1. For Raceway at more than 600V, provide black letters on an orange field label with the legend, “HIGH VOLTAGE”. Indicate feeder number.

F. Plain-colored vinyl adhesive tape, 3-mil minimum by 1-inch-wide minimum. Apply 1/2-inch minimum over-wrap through 2-inch minimum length. Refer to Section 26 05 19 – 600 Volt or Less Wire and Cable for color.

G. Engraved plastic melamine laminate flat stock. 1/16-inch minimum thickness for sizes up to and including 15 square inches, 1/8” thick for larger than 15 square inches. White background with black letters for normal power, red background with white letters for emergency power. Holes at each end for attachment with nylon ty-wraps.

H. Underground line warning tape with pre-printed warning message identifying type of system. Material shall be pigmented polyolefin, continuous-printed on one side, and compounded for unlimited life when direct buried. 6-inch minimum width by 4-mils thick. Tensile strength of 1750 psi.

1. Inscriptions for Red-Colored Tapes: ELECTRICAL LINE, HIGH VOLTAGE.

2. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATION CABLE, OPTICAL FIBER CABLE.

I. Underground metallic line-warning tape with pre-printed warning message identifying type of system. Material shall be detectable three-layer laminate consisting of printed pigmented polyolefin, a solid aluminum-foil core with a clear protective film that allows inspection of the continuity of the conductive core, and compounded for unlimited life when direct buried. Use

when metal-detection of line is required on Medium Voltage Systems. 6-inch minimum width by 4-mils thick.

1. Inscriptions for Red-Colored Tapes: "CAUTION: MEDIUM VOLTAGE ELECTRICAL LINE BELOW".

J. Warning signs: Baked Enamel on aluminum plate, punched or drilled for fasteners, with colors, legend, and size required for applications. ¼-inch grommets in corners for mounting. Minimum nominal size of 7 by 10 inches with 0.040-inch minimum thickness. OSHA standard wording where approved. Custom wording if required. Secure with non-corrosive fasteners.

1. Where applicable, provide labels for multiple power source warning: "DANGER – ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES"

K. Warning labels: Self-adhesive, multicolor, flexible pressure-sensitive vinyl conforming to OSHA "Danger" and "Caution" standards. 2½ x1¾" minimum with black letters on yellow background. Label shall read: "WARNING! DO NOT USE AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL - CABLES ADDED AFTER INITIAL INSTALLATION REQUIRE POS/F & I APPROVAL." See Section 26 05 33 – Raceways.

1. Where applicable, provide labels for multiple power source warning: "DANGER – ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES"

L. Stencils: Machine-punched patterns, nonfading waterproof paint with color and formulation appropriate for material and location. Minimum letter height shall be 1 inch.

M. Adhesive-backed metal labels manufactured with testing agency logo. Punched or engraved with actual settings and date. Label shall be 1/16-inch minimum thickness for sizes up to 15 square inches. Use 1/8-inch minimum for sizes larger than 20 square inches. Black with white letters for normal power systems and red with white letters for emergency power systems, with height as shown in table above unless specified otherwise.

N. Stainless-steel machine or hand-stamped wire marker plates with one hole at each end for attachment with non-corrosive fasteners that do 0.010-inch minimum thickness (for outdoor application).

O. Adhesive machine-printed plastic tape, cut to length, black with white letters unless specified otherwise. 3/8-inch minimum width of tape in unfinished areas only. Provide white lettering on red background when served by an emergency source.

2.2 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Floor Marking: Coordinate with the Port Electric Shop for painting working clearances on the floor in front of the equipment.

B. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior and interior).

PART 3 EXECUTION

3.1 INSTALLATION

A. Fasteners for labels and signs: Self tapping, blunt-ended stainless-steel screws, or stainless-steel machine screws with nuts and flat and lock washers. Sheet metal screws are not acceptable. Self-drilling screws are not allowed.

B. Install identification labels according to manufacturer's written instructions.

C. Install labels where indicated and as required by the Authority Having Jurisdiction and the Department of Labor and Industries. Locate for optimum viewing and without interference with the operation and maintenance of equipment.

D. Verify identity of each item before installing identification products.

E. Labeling abbreviations not permitted without F&I approval.

F. Temporary markings allowed only if removable without damage to equipment or enclosure finish.

G. System Identification Color-Coding Bands for Raceways: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

1. 208/120V Blue
2. 480/277V Yellow
3. Controls Black

H. Cable Ties: For attaching tags. Use general-purpose type, fungus inert, self-extinguishing, one-piece, self-locking Type 6/6 nylon, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In spaces handling environmental air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Coordinate names, abbreviations, colors, graphics and other designations used for electrical identification with corresponding designations used in the Contract Documents or as required by codes and standards. Use consistent designations throughout the Project. Labeling abbreviations are not allowed.

K. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish Work.

1. Coordinate installing electrical identifying labels prior to installing acoustical ceilings and similar finishes that conceal such items.

L. Clean surfaces of dust, loose material, and oily films before applying painted or self-adhesive identification products.

M. Painted Identification Products:

1. Prime surfaces according to manufacturer's instructions prior to applying painted labels:

a. For galvanized metal, use single-component, acrylic vehicle coating formulated for galvanized surfaces.

b. For concrete masonry units, use heavy-duty, acrylic-resin block filler.

c. For concrete surfaces, use clear, alkali-resistant, alkyd binder-type sealer.

2. Apply one intermediate and one finish coat of paint.

3.2 IDENTIFICATION SCHEDULE

A. Panelboard Schedules:

1. Panelboard schedules shall be type-written and printed with a finalized copy shall be laminated and placed interior to the panel for future reference.

B. Instrumentation Labels: Affix permanent type nameplate or tag on all field-mounted instruments, transmitters, pressure gauges, and control valves with proper identification number and service description.

1. Provide 3"x1" aluminum or stainless-steel tag stamped with the instrument loop number designation and the calibrated range.

C. Medium Voltage Raceways: Provide 5/8-inch-high stenciled or manufactured letters noting "HIGH VOLTAGE", black letters on yellow background on all exposed feeder conduits where entering or leaving switchboards and along conduit runs at 25 feet on center.

D. Accessible Raceways, More Than 600 V: Self-adhesive vinyl labels. Install labels at all conduit penetrations and along length of exposed conduit run at 25-foot maximum intervals.

E. Accessible Raceways within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage.

1. Provide labels on all raceways, junction and pull boxes indicating panel designation and circuit number for all circuits in raceway or box, and conduit destination.

a. Conduit Label Example: B2-P4-23G-1/1,3,5, B-2601-9.

b. Provide labels at all locations where conduit penetrates walls, floors and ceilings, on both sides of penetration.

c. Provide labels at all ends or breaks in conduit runs such as electrical rooms, junction boxes, pull boxes, cabinets, maintenance holes, fire penetrations, etc.

d. Provide labels on each conduit entering junction or pull box within 12” of junction or pull box.

e. Provide labels at 25-foot maximum intervals along conduit runs.

f. Provide labels on all junction and pullboxes, including in accessible ceiling spaces and exposed in unfinished areas. Refer to specification sections for identification requirements for systems contained within.

g. Install labels parallel to equipment lines.

h. Labels in unfinished locations, including in accessible ceiling spaces and exposed unfinished areas shall be machine printed vinyl labels minimum ½ inch high, white with black letters. Labels in finished locations shall be adhesive-backed plastic machine printed labels, minimum 3/8-inch-high, white with black letters.

i. Lettering shall be a minimum of ¼” high.

j. In finished locations, provide labels on inside of junction or pull box cover.

k. Provide red lettering when served by an emergency source.

F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for feeder and branch-circuit conductors.

a. Provide colored insulation when available, typically for wire sized #8 AWG and smaller.

b. Provide minimum 2-inch-wide band of colored plastic tape at all terminations and splices (where allowed). 3M Scotch No. 35, Or Approved Equal Electrical Color Coding Tape.

c. Colors for 480/277V 3Ø, 4-wire systems:

1)	Phase A (left or top):	Brown.
2)	Phase B (center):	Orange.
3)	Phase C (right or bottom):	Yellow.
4)	Neutral:	Gray.
5)	Ground:	Green.

d. Colors for 208/120V, 3Ø, 4-wire systems:

1)	Phase A (left or top):	Black.
2)	Phase B (center):	Red.
3)	Phase C (right or bottom):	Blue.
4)	Neutral:	White.
5)	Ground:	Green.
6)	Isolated Ground:	Green with yellow or orange stripe.

e. 575V, 3Ø, 4-wire systems:

1)	Phase A (left or top):	Brown with purple stripe.
2)	Phase B (center):	Orange with purple stripe.
3)	Phase C (right or bottom):	Yellow with purple stripe.
4)	Neutral:	Gray with purple stripe.
5)	Ground:	Green.

f. Colors for 120/240V, 1Ø, 3-wire systems: (non-standard)

1)	Phase A:	Black.
2)	Phase B:	Red.
3)	Neutral:	White.
4)	Ground:	Green.

g. For 240-delta systems (obsolete) the color of the high leg (approximately 200 volts to ground) shall be red. Label interior of all equipment "CAUTION: HIGH LEG IS OVER 120V TO GROUND. DO NOT USE FOR 120V CIRCUITS".

h. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

2. Provide wire markers on each conductor in panelboards, gutters, pull boxes, outlet and junction boxes and at the load connection. Identify with branch circuit or feeder number for power and lighting circuits.

a. Install conductor labeling in panelboards and enclosures to ensure labels are visible.

G. Power-Circuit Conductor Identification, Medium Voltage: Provide labeling at all accessible locations including each termination or interconnection of wiring, and in vaults, pull and junction boxes, manholes, and handholes. Identify conductors with cloth type, split sleeve or tubing type wire and cable markers.

1. Label each cable with phase designation, operating voltage and circuit number.

2. Color Coding for Phase:

a. 4160Y/2400V AC 3Ø, 4-wire:

1)	Phase A:	Black/Pink.
2)	Phase B:	Red/Pink.
3)	Phase C:	Blue/Pink.
4)	Neutral:	White/Pink.

b. 4160V Delta AC, 3Ø, 4-wire:

1)	Phase A:	Black/Brown.
2)	Phase B:	Red/Brown.
3)	Phase C:	Blue/Brown.

c. 12,470V Delta AC, 3Ø, 4-wire:

1) Phase A: Black/Orange.
2) Phase B: Red/Orange.
3) Phase C: Blue/Orange.

3. Provide write-on tags or nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

H. Install instructional sign including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

I. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

1. Provide wire markers on each conductor in wire gutters, pull boxes, outlet and junction boxes and at the equipment connection. Identify with control wire number as indicated on schematics and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

J. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes with the conductor designation.

K. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

L. Conductor Identification:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.

2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.

3. Multiple Control and Communications Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color coding, or cable marking tape.

M. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

N. Workspace Indication: Install floor marking tape or paint to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

O. Warning, Caution, and Instruction Signs:

1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Provide OSHA standard text where approved. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location. Mount permanently in an appropriate location. Comply with ANSI A13.1 standard color and design.

2. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

3. Emergency-Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

P. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide a single line of text with 1/4-inch-high lettering on 1-inch-high label. Use white lettering on black field. Apply labels parallel to equipment lines.

Q. Outdoor Equipment: Engraved, laminated acrylic or melamine label, to comply with requirements listed above. Provide panel schedule printed on 8.5x11 paper in Port standard format in each panelboard. Insert folded schedule in schedule holder on inside of panel door. Posted panel schedule shall be updated to reflect all new work in panel. Include project completion date on schedule.

R. Provide self-adhesive tape labels on all receptacle cover plates. Labels shall be machine printed with black lettering on white or clear background.

1. Indicate source panel name and circuit number.

2. Provide red lettering on white or clear background for devices on emergency circuits.

3. Where receptacle faceplate is dark color, provide white letters on clear background.

END OF SECTION

SECTION 26 05 73 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Execution

1.2 SCOPE

A. This section specifies the preparation of a Power System Study Report using PowerTools SKM, EasyPower or similar software. The report shall include arc flash analysis, short circuit and coordination studies for all voltage levels of the electrical power system. The "electrical power system" starts at and includes the utility feed. Refer to the single-line diagrams of this Contract for details of the electrical power system at the Site. Provide in the report an evaluation of the electrical power system and the model numbers and settings of the protective devices for the entire system. Arc flash analysis shall include the method and recommendation in determining proper Personal Protective Equipment (PPE) and proper labeling of equipment as specified in this section. Provide equipment arc flash warning labeling.

B. Arc-flash hazard studies shall include all new and modified equipment in the power distribution system including but not limited to:

1. Utility equipment.
2. Switchgear.
3. Switchboards.
4. Generators.
5. Transformers:
    a. Including all dry-type transformers.
6. Motor Control Centers.
7. Free standing variable frequency drives and starters.
8. Disconnect Switches.
9. Motors.
10. Panelboards:
    a. Including all 208, 240, and 480-volt systems.

11. Vendor Control Panels.

12. HVAC Equipment.

1.3 REFERENCE STANDARDS

A. 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.

B. 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
IEEE 141	Recommended Practice for Electric Power Distribution for Industrial Plants
IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
NFPA 70E	National Electrical Safety Code
IEEE 1015	Recommended Practice for applying Low Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
IEEE 902	Guide for Maintenance, Operation and Safety of Industrial and Commercial Power Systems
NFPA 70	National Electrical Code
IEEE 1584	IEEE Guide for Performing Arc-Flash Hazard Calculations

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. QUALIFICATIONS:

1. Prepared by the manufacturer of the electrical equipment or by an electrical testing service or an engineering company which is regularly engaged in power system studies.

2. All calculations shall be prepared by or prepared under direct supervision of an Oregon State registered Professional Electrical Engineer. See the General Conditions for insurance requirements.

C. CERTIFICATION: Arc flash report to be stamped and signed by an Oregon State registered Professional Electrical Engineer.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Qualifications of the entity conducting the short circuit and coordination study.

4. Short Circuit Analysis and recommended breaker and relay setting selections in coordination with Section 26 08 00.

5. Electronic copies of power study software models with associated electronic library files.

6. Submit a draft report to the OWNER within 21 days after receiving all electrical distribution system submittal data and feeder lengths. Approval of submittals shall be contingent on the results of the Power System Study Report.

7. SCOPE OF EQUIPMENT: CONTRACTOR shall provide a short circuit and protective device coordination study and arc flash analysis for phase and ground faults for the entire electrical distribution system. The study and labeling conforms to NFPA 70E and the National Electrical Code.

PART 2 PRODUCTS

2.1 POWER SYSTEM STUDY REPORT

A. Prepare a Power System Study Report summarizing the short circuit and coordination study, arc flash analysis and conclusions or recommendations which may affect the integrity of the electric power distribution system. The model and report shall reflect the project naming convention.

B. As a minimum, include the following in the report:

1. Equipment manufacturer's information used to prepare the study.

2. Assumptions made during the study.

3. Short circuit calculations listing short circuit levels at each bus.

4. Evaluation of the electrical power system and the model numbers and settings of the protective devices associated with the system.

5. Time-current curves including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker.

6. Comparison of short circuit duties of each bus to the interrupting capacity of the equipment connected to that bus.

7. Analyze the short circuit, protective device coordination, and arc flash calculations and highlight any equipment that is determined to be underrated or causes an abnormally high incident energy calculation. Propose approaches to reduce the energy levels.

8. Summarize the arc flash study and conclusions or recommendations which may affect the integrity of the electric power distribution system.

9. ONE-LINE DIAGRAMS:

    a. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.

    b. Type designation, current rating, range or adjustment manufacturer's style and catalog transformers.

    c. Power, voltage ratings, impedance, primary and secondary connections of all transformers.

    d. Nameplate ratings of all motors and generator with their subtransient reactances.

    e. Transient reactances of generator and synchronous reactances of generator.

    f. Sources of short circuit elements such as utility ties, generators, and induction motors.

    g. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc.

    h. Standby as well as normal switching conditions.

    i. Calculated 3-phase and single-line-ground fault currents at each bus.

    j. Calculated X/R ratio at each bus.

    k. Calculated incident energy level at each bus.

    l. Hazard Risk Category at each bus.

2.2 SHORT CIRCUIT STUDY

A. As a minimum, include the following:

1. CALCULATIONS:

a. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.

b. Calculate the maximum and minimum ground-fault currents.

c. Model variable frequency drives and Solid-State-Soft Starters and include by-pass switches.

d. Where the calculated available fault current is higher than the device ratings determine if a Series-rated system exists. Where series-rated systems have been identified provide labeling per NEC Article 110.22.

e. Provide labeling at each service and separately derived system indicating calculated available fault current per NEC Article 110.24.

f. A copy of the SKM or EasyPower "Device Evaluation Comprehensive Branch Report". Generate report after an "Equipment Evaluation" analysis has performed using the following settings:

1) Study Result: Balanced
2) Device Type: Protective Devices
3) Fault Type: Bus
4) Fault Study: Comprehensive

2.3 COORDINATION STUDY

A. As a minimum, include a 17"x11" drawing which includes protective device coordination analysis (TCC) and associated single line. The TCC shall be shown on a 5-cycle, log-log graph background and include:

1. Time-current curve for each circuit breaker, protective relay, or fuse showing graphically that the settings will allow protection and selectively within Industry standards. Identify each curve and specify the tap and time dial setting. Any circuit protective device that has programmable characteristics shall be included in the coordination study.

2. Time-current curves for each device to be positioned for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, notify the Engineer and OWNER as to the cause.

3. Time-current curves and points for cable and equipment damage.

4. Circuit interrupting device operating and interrupting times.

5. Indicate maximum fault values on the graph.

2.4 ARC FLASH ANALYSIS

A. As a minimum, include the following:

1. CALCULATIONS:

a. For each major part of the electrical power system, determine the following:

1) Flash hazard protection boundary.
2) Limited approach boundary.
3) Restricted approach boundary.
4) Prohibited approach boundary.
5) Incident energy level.
6) PPE hazard/risk category.
7) Type of PPE required.

b. Produce arc flash warning labels using the existing SKM or EasyPower model template.

c. A copy of the SKM or EasyPower "Arc Flash_IEEE 1584 Report". Generate report after an "Arc Flash Evaluation" analysis has performed using the following settings:

1) Standard: IEEE 1584
2) Flash Boundary Calculation Adjustments: Use 1.2 cal/cm^2
3) ≤ 240 V: Report Calculated Values from Equations
4) Units: English
5) Distance and Boundary: in

PART 3 EXECUTION

3.1 GENERAL

A. Perform the studies using actual equipment data from the equipment and devices that are provided by the CONTRACTOR and the data from the actually installed existing equipment or protective relay devices. The CONTRACTOR is responsible to gather all field information for the short circuit and coordination studies. Where the report or study is conducted on equipment that is not installed, the short circuit report and the coordination study shall be completely redone at the CONTRACTOR's expense.

3.2 IMPLEMENTING PDCS SETTINGS AND ARC FLASH SIGN INSTALLATION

A. The CONTRACTOR shall implement the protective device coordination study settings on new and existing equipment as required in Section 26 08 00, based on the accepted Protective Device Coordination Report specified herein and submit a final amended report of the Record As-Built electrical equipment protective device settings subsequent to start-up and testing.

B. The CONTRACTOR shall work with the Study Firm for implementing the Arc Flash Hazard sign installation requirements for electrical equipment as specified in NEC Article 110.16 Flash Protection and NFPA 70E.

END OF SECTION

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Testing.
7. Functional Checkout.

1.2 SCOPE

A. This section specifies the acceptance testing of electrical materials, equipment, and systems. Provide all labor, tools, material, power, and other services necessary to provide the specified tests. All testing described in this section shall be coordinated with the requirements of Section 01 75 16.

1.3 REFERENCE STANDARDS

A. 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.

B. 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 other- wise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ANSI/NETA ATS- 2009	Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment Systems

C. APPLICATION: Where testing in accordance with this section and other Division 26 Sections is required, the required tests, including the retesting after the correction of found defects must be complete, and the submittal of final test reports to the OWNER for review shall be completed prior to the energizing of material, equipment, or systems.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

    d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

4. Proposed testing procedures including proposed test report forms.

5. Test reports including documentation for all tests performed. Test reports shall be submitted for review prior to the equipment being energized.

6. Execution plan including schedule.

7. All testing required herein and the test results shall also be submitted and documented as required under Sections 01 75 16, 26 05 00, and where identified within the specific sections.

8. Test results for a specific piece of equipment shall also be included in the operation and maintenance manual(s).

PART 2 PRODUCTS

2.1 TESTING EQUIPMENT AND INSTRUMENTS

A. The test equipment, instruments and devices used for testing shall be calibrated to test equipment standards with references traceable to the National Institute of Standards and Technology. The test equipment, instruments and devices shall have current calibration stickers indicating date of calibration, deviation from standard, name of calibration laboratory and technician, and date of next recalibration.

2.2 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00 and Section 01 75 16:

1. Defects: Notify the OWNER of any material or workmanship found defective within 24 hours of discovery.

2. Short circuit analysis and protective device curves.

3. Test reports: Provide the report required in NETA ATS-2009 paragraph 5.4. Results shall be placed on the forms specified in this Section. Test reports shall also be part of the operation and maintenance manuals.

PART 3 EXECUTION

3.1 TESTING

A. GENERAL

1. Ensure that all testing performed is in strict conformance with the electrical acceptance tests specified in Section 26 08 00. Contact the OWNER 10 days prior to the testing to allow witnessing of all tests.

2. The test measurements shall be recorded on specific forms for the subject test.

3. Testing shall be per ANSI/NETA ATS 2009. Provide testing data sheet for the following:

a. Switchboard assemblies.
b. Transformers – Small Dry-type, air cooled (600 VAC and below, 30 kVA and larger)
c. Cables – Low voltage (600 VAC maximum)

d. Circuit breakers – Low voltage (Insulated Case/Molded Case)
e. Protective Relays
f. Instrument Transformers
g. Metering and Monitoring Equipment
h. Grounding Systems
i. Ground Fault Protection Systems
j. Rotating Machinery
k. Motor Control
l. Variable Speed Drive Systems
m. Outdoor Generator Systems
n. Uninterruptable Power Systems
o. Manual and Automatic Transfer Switches

B. FUNCTIONAL CHECKOUT:

1. Functional testing shall be performed in accordance with the requirements of this Section. Prior to functional testing, all protective devices shall be adjusted and made operative. Prior to energizing the equipment, perform a functional checkout of the control circuits. Checkout shall consist of energizing each control circuit and operating each control, alarm or malfunction device and each interlock in turn to verify that the specified action occurs. Submit a description of proposed functional test procedures prior to the performance of functional checkout.

2. Verify that motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor after confirming that neither the motor nor the driven equipment will be damaged by reverse operation.

END OF SECTION

SECTION 26 22 13 - LOW VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Execution

1.2 SCOPE

A. This section covers the work necessary to furnish and install low voltage transformers.

B. The following supplements all sections of this specification and applies to all work specified, shown on the drawings, or required to provide a complete installation of approved electrical systems.

C. The CONTRACTOR shall furnish and install single-phase or three-phase general purpose individually mounted dry-type transformers, self-cooled as specified herein, and as shown on the contract drawings.

D. System Characteristics

1. 480/277 VAC 3 PHASE 4 WIRE: 120/208 VAC 3 PHASE 4 WIRE
2. 480 VAC 1 PHASE: 120/240 VAC 1 PHASE
3. 120 VAC 1 PHASE: 24 VDC

1.3 REFERENCE STANDARDS

A. 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.

B. Transformers shall meet the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".

C. 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
IEEE	Enclosures for Electrical Equipment (1,000 Volts Maximum)

NFPA 70	National Electrical Code
NFPA 70E	National Electrical Safety Code
UL 50	
UL 67	Underwriters Laboratories
NEMA	TP-1

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment first start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

4. Provide Seismic calculations for anchoring and support of equipment as required in Section 01 61 10.

5. Transformer Ratings including:

a. KVA rating
b. Primary & Secondary Voltage
c. Taps
d. Design Impedance
e. Insulation class
f. Sound level

1.6 DELIVERY, STORAGE AND HANDLING

A. PROCEDURES: Section 00 72 00 General Conditions

B. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

C. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

PART 2 PRODUCTS

2.1 CANDIDATE MANUFACTURES/PRODUCTS

A. Candidate manufacturers and models are listed below. To conform to specified requirements, the manufacturer's standard product may require modification.

1. Eaton
2. Schneider Electric / Square D
3. GE
4. Approved Equal

2.2 DRY TYPE TRANSFORMERS

A. General: Provide all power transformer equipment as shown on the drawings in conformance with the following specification. All transformers shall be built in accordance with the latest revised IEEE, ANSI, and NEMA standards. All transformers shall conform to NEMA TP-1 standards.

B. Temperature Ratings: On all transformers, case temperature shall not exceed 30 degrees Centigrade rise above an ambient temperature of 40 degrees Centigrade. Terminal compartment shall be located to ensure termination of cable leads in temperature levels not to exceed 75 degrees Centigrade. Transformers shall be designed for full load operation at a maximum temperature rise of 115 degrees C.

C. Size: Voltage and KVA rating shall be as shown on the drawings. Provide continuous overload capability of 15%. Primary voltage windings shall have a BIL rating of 10 kV.

D. Enclosure: For general application, enclosures shall be drip-proof and rodent-proof. Ventilating openings shall be louvered; screening will not be acceptable. Design shall incorporate a built-in vibration dampening system. Finish shall be ANSI 60. Conform to the limited access requirements where applicable.

E. Core and Coil Assemblies: Transformer core shall be constructed with high-grade, non-aging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade copper with continuous wound construction.

F. Taps: Furnish a minimum of four taps, two above and two below rated voltage, each 2-1/2 percent, for ratings above five (5) kVA.

G. Tests: Provide routine tests as listed and described in ANSI specification No. C57.12.00, latest edition. Sound level tests shall be performed on the complete transformer assembly in accordance with the latest NEMA standards. Transformer 0-75 kVA shall conform to NEMA standards.

PART 3 EXECUTION

3.1 EQUIPMENT BASES

A. Provide equipment bases for all floor-mounted electrical equipment. Unless otherwise indicated, bases shall be poured-in-place concrete, nominally four inches high, and be one inch larger on all exposed edges than the equipment to be mounted. Bolt equipment to pad. Provide concrete pads and mounting provisions for all exterior equipment as indicated on the drawings or specified in other portions of the specifications.

3.2 SUPPORTS

A. Provide equipment bases for all floor-mounted electrical equipment. Unless otherwise indicated, bases shall be poured-in-place concrete, nominally four inches high, and be one inch larger on all exposed edges than the equipment to be mounted. Bolt equipment to pad. Provide concrete pads and mounting provisions for all exterior equipment as indicated on the drawings or specified in other portions of the specifications.

B. Provide Uni-strut or similar supports and backing for wall mounted equipment where structure is suited for such mounting.

3.3 DAMP AND WET LOCATIONS

A. Unless otherwise specified, all electrical enclosures in damp and wet locations shall be NEMA 4, stainless steel.

B. All conduit entries into equipment located in damp or wet locations shall be through the bottom or lower sides of enclosures. Top entry of conduits will not be allowed.

END OF SECTION

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SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Executions

1.2 SCOPE

A. This section specifies panelboards for lighting and power distribution.
B. Panelboards shall be labeled for arc-flash conditions in accordance with Section 26 05 73.

1.3 REFERENCE STANDARDS

A. 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.

B. 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
IEEE	Enclosures for Electrical Equipment (1,000 Volts Maximum)
NEMA PB 1	Panelboards
NFPA 70	National Electrical Code
UL 50	Cabinets and Boxes
UL 67	Underwriters Laboratories, Electric Panelboards
UL 489	Molded-Case Circuit Breakers and Circuit Breaker Enclosures
UL 1449	Surge Suppression Devices, Third Edition

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

    d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

4. Provide Seismic calculations for anchoring and support of equipment as required in Section 01 61 10.

5. Manufacturer's certification that bus bracing is capable of withstanding the specified short circuit condition.

6. Quantity and rating of circuit breakers provided with each panelboard.

1.6 DELIVERY, STORAGE AND HANDLING

A. PROCEDURES: Section 00 72 00 General Conditions

B. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

C. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

PART 2 PRODUCTS

2.1 CANDIDATE MANUFACTURERS/PRODUCTS

A. Panelboards shall be fully rated with a main circuit breaker and shall be dead front type, bolt-on breaker type, with bus bar construction.

B. Candidate manufacturers and models are listed below. To conform to specified requirements, the manufacturer's standard product may require modification.

1. Eaton
2. Schneider Electric / Square D
3. GE
4. Approved Equal

2.2 ARRANGEMENT AND CONSTRUCTION

A. The front of the panel shall have concealed trim clamps and hinges. The locks shall be flush with cylinder tumbler-type with spring loaded door pulls. The fronts shall not be removable with doors in the locked position. All panelboard locks shall be keyed alike.

B. Gutter space shall be provided on all sides of the breaker assembly to neatly connect and arrange incoming wiring.

C. Panelboard shall be composed of individually mounted circuit breakers designed to be removable without disturbing other breakers.

D. Panelboards shall have interior hinged face plates that can swing open while not disturbing the circuit breakers.

E. Panelboards shall be provided with factory installed breaker lock-out means allowing a padlock to lock the breaker in the "off" position.

F. Panelboards shall be mounted as shown on the construction documents.

G. A directory holder with clear plastic plate and metal frame shall be mounted on the inside of the door. A typed panel schedule showing as-built configuration shall be provided by the CONTRACTOR.

H. Panelboards shall have lockable Door-in-Door type covers.

I. Panelboard circuit breakers shall be provided with locking tabs to enable OSHA lockout/tagout.

2.3 BUS

A. Bus shall be tin-plated copper and shall have current ratings as shown on the panelboard schedules, sized in accordance with UL 67. Ratings shall be determined by temperature rise test. Minimum bus size shall be 100 amperes. Panel fault withstand rating shall be equal to the interrupting rating of the smallest circuit breaker in the panel.

B. Panelboards shall be provided with a separate ground bus and, where specified, with a full capacity neutral bus.

C. The neutral bus of power panels shall be mounted on insulated stand-offs.

2.4 CIRCUIT BREAKERS

A. Circuit breakers shall be molded-case type provided for the current ratings and pole configurations specified on the panelboard schedule. Circuit breakers rated 120/208 volt and 120/240-volt alternating current shall have a minimum interrupting current rating of 10,000 amperes (symmetrical) at 240V AC. Circuit breakers rated 480-volt alternating current shall have a minimum interrupting current rating of 14,000 amperes (symmetrical) at 480V AC or as specified on the panelboard schedule.

B. Circuit breakers shall be bolt-on type.

C. Circuit breakers shall be listed in accordance with UL 489 for the service specified.

D. Load terminals of circuit breakers shall be solderless connectors.

2.5 FINISH

A. Panelboard cabinet shall be fabricated from hot-dip galvanized steel in accordance with UL 50. Panelboard fronts shall have a gray, baked enamel finish.

2.6 NAMEPLATES

A. Nameplates shall be provided in accordance with the requirements of Section 26 05 53.

PART 3 EXECUTION

3.1 GENERAL

A. The CONTRACTOR shall type in the circuit description on the circuit directory as shown on the final record drawings or panelboard schedule.

B. Provide “Circuit Directory and Circuit Identification” in accordance with NEC 408.4A and B. Each circuit shall be of sufficient detail to allow each circuit to be distinguished from other circuits. Circuit identification shall include load location and provide equipment or instrument Tag Number and Tag Description, where shown on the drawings.

END OF SECTION

SECTION 26 24 19 - MOTOR-CONTROL CENTERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Products
6. Execution

1.2 SCOPE

A. Motor Control Centers as specified and as shown on the contract drawings shall be furnished and installed by the Contractor.

B. The drawings are the basis for required programming within the MCC for manual operation of the motor starters. The manufacturer or its designated field service group shall program, test, commission and certify operation of the MCC equipment.

1.3 REFERENCE STANDARDS

A. The Motor Control Center shall be manufactured and tested according to the latest applicable standards of the following agencies:

Reference	Title
UL 845	Motor Control Centers
NEMA ICS 18-2001	Motor Control Centers
NEMA ICS 1-2001	Industrial Control and Systems: General Requirements
NEMA ICS 2.3-2008	Industrial Control and Systems: Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers

1.4 QUALITY ASSURANCE

A. REQUIREMENTS:

1. Section 26 05 00 General Requirements for Electrical Work.
2. Section 26 13 13 Across-the-Line Motor Controllers
3. Section 26 43 13 Surge Protective Devices for Low-Voltage Electrical Power Circuits

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Arrangements and dimensions shown on the drawings are provided to show intent. Contractor and equipment supplier are to verify installation requirements and ensure the arrangement of the equipment being submitted will suit the intent of the design and is compatible with the installation requirements.

    Where the proposed arrangement differs from the intent shown on the drawings, the contractor is to make note of the variance and offer an explanation for the change.

4. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

    d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

C. Provide Seismic calculations for anchoring and support of equipment as required in Section 01 41 20.

D. Certificate of Compliance for Seismic Design of Nonstructural Components and Systems.

E. Manufacturer Seismic Qualification: The low voltage motor control center(s) shall meet and be certified to seismic requirements specified in the IBC 2018 International Building Code. Refer to Specification section 01 61 10.

1.6 QUALITY ASSURANCE

A. Manufacturer: For equipment required for the work of this section, provide products which are the responsibility of one manufacturer.

B. Manufacturer shall have had produced similar electrical equipment for a minimum of 5 years.

C. Manufacturer shall be ISO 9001 certified.

1.7 DELIVERY, STORAGE AND HANDLING

A. PROCEDURES: Section 00 72 00

B. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manual. One (1) copy of this document shall be provided with the equipment at the time of shipment.

C. 'Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products from one of the following:

1. ABB
2. Allen Bradley
3. Group Schneider/Square D
4. Eaton
5. Approved Equal

2.2 GENERAL REQUIREMENTS

A. STRUCTURES

1. The enclosure shall be NEMA Type 1A with gasketed doors. Vertical sections shall be constructed with steel divider sheet assemblies formed or otherwise fabricated to eliminate open framework between adjacent sections or full-length bolted-on side sheet assemblies at the ends of the MCC(s).

2. Vertical sections shall be 90” high excluding mounting sills, 20” wide and 20” deep for front mounting of units.

3. Vertical structures shall be divided into six (6) 12” space factors and shall accommodate six (6) full size NEMA size 1 or 2 Full Voltage Non-Reversing FVNR combination starters. MCC unit sizes shall be multiples of 1/2 space factor (6”). The vertical structures shall accommodate 6” high density and dual mounted units.

4. Back-to-back, front and rear unit mounting, structures shall be 21” deep maximum and shall accommodate 12 full size NEMA size 1 or 2 Full Voltage Non-Reversing FVNR combination starters per section.

5. 4” wide wireways shall be installed on 20” wide structures and 8” wide wireways on 24” wide structures. Wireways shall be completely isolated from all power busses. The rear surface of the vertical wireway shall be painted white. A minimum of three (3) formed wire cable supports, extending the full depth of the vertical wireway shall be supplied in each vertical section. A separate hinged door shall cover the vertical wireway.

6. Each standard structure shall be supplied with a 12-inch top and six (6) inch bottom horizontal wireway that are continuous for the entire length of the MCC. The minimum horizontal wireway opening between sections is 40 square inches for the top and 30 square inches for the bottom horizontal wireway. A hinged door shall be supplied to cover the top horizontal wireway.

7. Doors are to be hinged in a manner that allows for the removal of individual doors without the removal of any door above or below. Unit doors shall be hinged on the left and vertical wireway doors on the right for unobstructed access to the units and associated vertical wireway. All doors shall be mounted on removable pin-type hinges and secured with steel quarter-turn, indicating type fasteners.

8. Wireways shall be completely isolated from bus compartments by suitable barriers. Sliding barriers between the horizontal bus and top horizontal wireway are not acceptable.

9. Removable top cover plates shall be provided for conduit entry to the top horizontal wireway and shall provide a minimum of 116 square inches of area for conduit location. Top cover plates shall be fabricated from 13-gauge steel.

10. All MCC structures shall be supplied with 1-1/8” high X 3” wide base channel sills that are continuous for the entire length of the shipping split. The base channel sills shall be fabricated of 7-gauge steel and shall be suitable for grouting the base channel sills in place, welding to leveling plates or securing to the floor with 1/2” anchor bolts. MCC structures shall be supplied with reversible bottom end cover plates to cover the bottom horizontal wireway and ends of the base channel sills. The bottom end cover plates shall be factory installed to cover the ends of the base channel sills to prevent entrance of dirt and rodents into the MCC when installed flush on the floor and shall be removable to expose the ends of the base channel sills if they are to be grouted into the floor.

11. A removable, full length lifting angle shall be provided for each shipping split of each MCC. The lifting angle shall be bolted to each side sheet or divider sheet of the shipping split to evenly distribute the weight of the MCC during lifting.

12. MCC's shall be assembled in such a manner that it is not necessary to have rear accessibility to remove any internal devices or components.

B. BUSSING

1. The main horizontal bus shall be:

   a. Tin plated copper with current rating as shown on the drawings with a 600 amperes minimum and with a conductivity rating of 100% IACS. The horizontal bus bars shall be fully sized to carry 100% of the rated current the entire length of the MCC. Horizontal bus bars shall be mounted edge wise and located at the top of the MCC. Tapered horizontal bus is not acceptable.] All power bus shall be braced to withstand a fault current of 65,000 RMS symmetrical amperes.

   b. The entire horizontal bus assembly must be located behind the top horizontal wireway at any amperage. Horizontal bus bars located behind usable unit space are not acceptable.

   c. The horizontal bus shall be isolated from the top horizontal wireway by a clear, flexible, polycarbonate, barrier allowing visual inspection of the horizontal bus without removing any hardware.

2. The vertical bus:

   a. Shall be rated 300 amperes. Vertical bus bars shall be fabricated of tin-plated solid copper bars with a conductivity rating of 100% IACS.

   b. The vertical bus assembly shall be isolated from the unit mounting space by means of a full height steel barrier. Provisions shall be made to close off unused unit stab openings in the vertical bus barrier with removable covers.

3. All bus ratings are to be based on a maximum temperature rise of 65ºC over a 40ºC ambient temperature.

4. Horizontal to vertical bus and horizontal bus splice connections shall be made with two (2) 3/8" grade 5 bolts and conical washers at each connection point. All connecting hardware shall be designed to be tightened from the front of the MCC without applying any tools to the rear of the connection.

5. The horizontal ground bus shall be rated 300-amp copper.

6. The neutral bus connection shall be rated 600-amp copper.

C. UNITS

1. Plug-in units shall connect to the vertical bus by means of self-aligning, tin plated copper stab-on connectors provided with spring steel back-up springs to insure positive connection to the vertical bus.

2. When vertical ground bus is specified, plug-in units shall include a ground stab which engages the vertical ground bus before the power stabs engage the vertical bus when the

unit is inserted into the structure. When the plug-in unit is withdrawn from the vertical bus, the vertical ground stab shall release after the power stabs.

3. The interior of all MCC units shall be painted white, including unit top and bottom plates or isolation barriers.

4. All plug-in units 12" tall and larger will include two (2) auxiliary handles to aid in installation, removal and transporting plug-in units.

5. All plug-in units will include a racking mechanism to assure full engagement with the stab-on connectors with the vertical bus.

6. Plug-in units shall be provided with interference mechanism type draw-out to prevent complete removal of the plug-in unit from the structure in one motion. The interference mechanism shall also provide clear indication when the plug-in unit has been withdrawn to the "TEST" position.

7. A mechanical interlock shall be supplied on all plug-in units to prevent insertion or removal of a unit from the structure when the unit operator handle is in the ON position. This interlock may not be defeated.

8. Each 12" tall and larger plug-in unit shall be secured in the structure by two (2) readily accessible devices, one of which is tool operated. These devices shall be located at the front of the unit.

9. Plug-in units with NEMA Type B or C wiring shall be supplied with unit terminal block mounted within the unit, adjacent to the vertical wireway. For non-high density units, the terminal blocks shall be mounted on a movable bracket that maintains the terminals inside the unit structure for normal operation and pivots into the vertical wireway exposing the terminals for wiring, test and maintenance.

10. All plug-in units shall include a positive means of grounding the unit to the structure at all times.

11. The MCC unit disconnect operator shall operate in a vertical, up-down, plane. 6" units shall operate in a horizontal motion. All unit disconnects shall remain engaged with the disconnect device at all times, regardless of the unit door position. The operating handles shall be interlocked with the unit door so that the door can neither be opened with the disconnect device in the ON position, nor can the disconnect device be turned ON with the unit door open except by operation of a defeater mechanism. Indication of the disconnect device shall be clearly indicated by the position of the operating handle. When applied with circuit breaker devices, the handle shall also provide clear indication of a circuit breaker trip.

12. When pilot lights, push buttons or sector switches are specified. The devices shall be mounted in a formed metal device panel that is capable of accepting four (4) such devices in any combination. The device panel shall be secured to the unit door for normal operation, or mounted on the plug-in unit as required for unit removal and bench testing.

13. Pilot devices shall be heavy duty, oil tight 30mm devices with a NEMA 4 rating. Indicating lights shall be LED push-to-test type. Pilot device contacts shall be rated at 10A, 600 VAC (NEMA A600). The pilot device bodies shall be fabricated from metal.

14. Unit identification nameplate shall be provided for each unit. Nameplates shall be a black surface with white core. Engraving shall cut through the black surface exposing white lettering of the unit designation. Nameplates shall be 1" tall by 3 1/2" wide. Adhesives or glues are not an acceptable means of mounting unit nameplates.

D. WIRING

1. The wiring shall be NEMA Class 1.
2. All internal wiring shall be labeled using heat shrink type material.

E. FEEDERS

1. Feeder disconnects shall be thermal-magnetic circuit breakers.

2.3 COMBINATION MOTOR STARTERS

A. Refer to Section 26 29 13.13 – Across -the-line Motor Controllers.

2.4 METERING

A. Multifunction digital-metering monitors shall be, microprocessor-based unit suitable for three or four wire systems.

B. The meter shall be mounted on the door and shall meter at the Main Lugs

C. Metering Equipment

1. Provide a multi-function, high accuracy digital power metering instrumentation module equipped with LCD display. The power metering module shall provide simultaneous measurements for current, voltage and power parameters. Power meter shall be equipped with a communications port for Profinet connection.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall be per the manufacturer's recommendations, written instructions, final shop drawings, and contract documents. Installation shall be coordinated with adjacent work to ensure proper sequence of construction, clearances and support.

B. The Motor Control Center shall not be placed in hazardous locations. The location shall be well ventilated and free from humidity, dust, and dirt. The temperature shall be no less than 32°F and no greater than 104°F. Protection shall be provided to prevent moisture from entering the enclosure.

3.2 TESTING

A. Perform factory and installation tests in accordance with applicable NEMA and UL requirements.

B. Provide technically certified personnel on site to perform pre-energization tests and provide certificate of proper installation.

C. During acceptance testing, provide technical personnel onsite with capability to diagnose errors, program MCC equipment and resolve any problems within the MCC system.

D. Provide services of manufacturer's representative for testing and commission per Section 01 75 16.

3.3 TRAINING

A. Provide 4 hours of onsite training for MCC maintenance.

B. Training shall include instruction on programming equipment supplied within the MCC center including the Power Meter and Soft Starters.

END OF SECTION

SECTION 26 27 16 - LOCAL CONTROL PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Product Requirements.
6. Testing.

1.2 SCOPE

A. This section specifies local control panels used for housing electrical power and control equipment. Local control panels that include motor controllers and control devices/instruments shall have a physical barrier separating the components into two compartments.

B. Vendor and Manufacturer panel requirements are specified in the related Sections for packaged equipment and in this Section. CONTRACTOR custom panels are specified herein and shown on the drawings.

C. Panels shall be labeled with fault current rating per NEC article 409.110 and arc flash warning label per NEC Article 110.16.

D. The Vendor / Manufacturer package equipment and CONTRACTOR custom field panels shall adhere to the requirements in specifications Section 26 29 23 for variable frequency drive motor controllers, and the circuits shall be arranged for Fail-Safe wiring and electrical operation, as defined hereinafter.

E. Refer to Control System Equipment and Panels – Section 40 92 00 for additional requirements.

F. Refer to Package Process Control Systems – Section 40 95 11 for Programmable Logic Controller (PLC) based control systems installed in this section's local control panels.

G. Refer to process equipment control descriptions in the Equipment Sections for system operation and interlock requirements.

1.3 REFERENCE STANDARDS

A. This section contains references and information from 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.

1. 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).

2. 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
NFPA 79	NFPA 79 Electrical Standard for Industrial Machinery
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 6	Industrial Control and Systems: Enclosures
NFPA 70	National Electrical Code
UL 508A	Industrial Control Panels
UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

C. The assembled panels and individual components shall be UL Listed and labeled.

D. Equipment and components shall be Underwriters Laboratory (UL) listed for the purpose per Section 26 05 00 or UL recognized.

E. The control panels shall have factory applied UL 508A labels.

F. The intrinsic safety barriers required within a control panel shall be provide per UL 698A with factory applied labels as required by UL.

1.5 SUBMITTALS

A. Submittals requirements specified in: Section 01 33 00 and 26 05 00.

B. Product Data: For each type of device and system:

1. Include product data sheets and equipment brochures showing standard products and specified accessories.

a. Arrangement drawings of the panel enclosure indicating the front door and panel equipment arrangement and dimensions, and enclosure type.

b. List of materials and components with the layout drawings.

c. Data on all materials and components.

d. Heat calculations.

e. Nameplate schedule with character size and nameplate size.

2. Submittal drawing required:

a. Elementary/schematic diagrams.
b. Internal wiring connection diagrams.
c. External wiring interconnection diagrams including interlocks.
d. Power and control single line diagrams, where motor controllers are included.

3. Provide Seismic calculations for anchoring and support of equipment as required in Section 01 61 10.

4. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required".

1.6 PRODUCT REQUIREMENTS

A. The Vendor / Manufacturer package equipment and CONTRACTOR custom field panels shall adhere to the requirements in this specification and other sections of Division 26 and 40.

1.7 TESTING

A. Prior to shipment, the manufacturer shall test the functional operation of the control panels.

B. Perform operational testing of the panel's control system at the assembly shop in two parts. Initial testing shall include, but not be limited to, operation of all input and output (I/O) points, control devices and motor controls 24 hours per day for a continuous period of at least 2 days. Provide connections (copper, fiber optic, RF, or other media) to provide communication between control panels and other system components. Subsequent testing of the system shall include, but not be limited to, programming of the PLC and Operator Interfaces. Provide the PLC system program as required.

C. The initial testing of the control system shall include configuration of the PLC and its communications equipment, energizing each digital input and output and simulating each analog input and output using a loop simulator and calibrator. Circuits not energized shall be tested for continuity. Energized circuits shall be tested through all components from the terminal blocks in the control panel to the hardware I/O memory locations in the PLC. Initial testing of the control system shall be considered completed only after the control system has operated continuously, 24 hours per day, for at least one week.

D. Provide an I/O checklist for all points in the control panel. The list shall include for each point, the tag name of the points, a description of the point, comments, date and time of the test, and a signature line for the person performing the test. Show that each Digital point was set

and reset. Show verification of all Analog points at 0%, 25%, 50%, and 100% of range. The Checklist shall be submitted 1 week prior to the Software Test.

E. After completion of initial testing, conduct subsequent testing for inspection by the OWNER. Load and test the program in the control system for a period of up to 6 working days. All control functions and all status and alarm monitoring and indication shall be demonstrated under simulated operating conditions. Simulating equipment shall be provided and wired into the control system for this testing. Revise, modify, and adjust the system as required by the OWNER during the testing period. Testing shall be continued for the time period required by the OWNER to observe and verify any revisions and shall continue to the OWNER's satisfaction.

F. Software testing shall not begin until the panels have been completed and verified by the OWNER.

G. Provide all hardware and software necessary to perform the software test. This includes test cables, Volt-Ohm meters, communications cables, and sufficient space are available in the Hardware Integrators shop to perform the software test.

H. Notify the OWNER at least 1 week prior to completion of the control system for inspection and testing by the OWNER. Testing and inspection shall include all control components, motor control centers, control panels, and shall take place at the Integrators shop. Motor control centers, switchboard, and ATS's, control panels and other control components shall not be shipped to the site until inspection and testing is complete to the satisfaction of the OWNER and written authorization from the OWNER has been received.

1.8 DELIVERY, STORAGE AND HANDLING

A. PROCEDURES: Section 00 72 00 General Conditions

B. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

C. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

PART 2 PRODUCTS

2.1 GENERAL

A. Panels shall comprise cabinet enclosures with power products, control products, and instrumentation products as specified in other sections and herein. Provide:

1. Separation between the power components (over 120 Vac) and the control/instrument components (120 Vac and less) by locating the power components and the control/instrument components in separate sections of the cabinet enclosure.

2. Power cabinet section and the control/instrument cabinet section with separate door handles.

3. Separation between the power components and the control / instrument components using barriers.

4. External lockable circuit breaker handle for the main panel disconnect.

5. Individual power and control components with internal circuit breakers, as required.

6. Displays with door-in-door construction accessible by opening the cabinet outer door.

7. Face-mounted equipment flush or semi-flush with flat-black escutcheons.

8. Panel tops of wall-mounted panels: mounted at the same elevation.

9. Panel inner door contains a copy of the record drawings.

10. Panel inner door contains a drawing holder.

11. Panel drawings enclosed in a transparent, protective jacket.

12. Panel functions as specified.

13. Panels with floor stands, to raise the top of the panel to 60 inches above the floor or work platform.

14. Wall mounting of panel weighs less than 100 pounds, where wall space is available.

2.2 ENCLOSURES

A. GENERAL: Panel enclosures shall comply with the requirements of NEMA 250.

B. MANUFACTURER: The enclosures shall be made by:

1. Hoffmann Enclosures, Inc.
2. Rittal.
3. Saginaw
4. E. M. Wiegman and Co., Inc.
5. Or Approved Equal

C. ENCLOSURES: Table A specifies the instrument and control panel enclosure material and minimum NEMA rating for the location and application.

1. All Exterior Mounted Enclosures on this project site must be non-reflective. Use of Polycarbonate or Painted Mild Steel enclosures in place of Stainless is acceptable for Exterior locations.

Table A

Location	Enclosure Material and NEMA Rating
Indoor, non-process areas	NEMA 12: mild steel
Indoor, process areas	NEMA 12: mild steel when specified with mounting pad or legs for minor splash resistance) or NEMA 4X: 316 Stainless Steel
Outdoor	NEMA 4X: 316 Stainless Steel
Process Corrosive	NEMA 4X: 316 Stainless Steel

Table A

Location	Enclosure Material and NEMA Rating
Hazardous Area:	NEMA 7: Galvanized Malleable Iron or Aluminum or NEMA 4X and UL listed or FM Approved for the Hazardous Area.
Hazardous and Corrosive Area	NEMA 4X/7: Iron or Aluminum with factory applied corrosion resistant coating or NEMA 4X and UL listed or FM Approved for the Hazardous Area.

D. SIZE: The minimum enclosure area, height by width, shall be twice the sum of the area of the individual components mounted on the back panel. The enclosure depth shall depend on the type of components used but shall be no less than 6 inches.

E. BOXES AND HAND STATIONS (IN NON-HAZARDOUS AREA)

1. All terminal, pull and junction boxes, and hand stations installed indoors in dry areas shall be NEMA 12 non-metallic. Those installed in damp, or corrosive or outdoor areas shall be NEMA 4X Type 316 stainless steel. AB bulletin 800H or equal.

2. Screws, bolts, and other hardware shall be stainless steel. Hinges shall have stainless steel pins. All enclosures with covers more than 1 square-foot total area shall be hinged.

3. Small boxes and control stations shall have 2 screw driver or hand operated latches.

F. BOXES AND HAND STATIONS (IN HAZARDOUS AREAS):

1. All terminal, pull and junction boxes, and hand stations installed in hazardous areas shall be rated for the area installed and shall be made of aluminum or non-metallic. Those in damp, outdoor, or corrosive environments shall be provided with corrosion resistant materials.

2. Provide stainless steel hinges, screws, bolts, and other hardware. Provide with neoprene gaskets.

3. Provide CROUSE-HINDS GUA, GUB, GUE, preferred. CROUSE-HINDS EJB with hinges are also acceptable. Or approved equal.

G. WIREWAYS: Provide molded plastic wireways, slotted for wire connections for all wiring in the panels. They shall be complete with covers. Wireways shall be manufactured by Panduit, Taylor, or approved equal.

H. PANEL LIGHT, SWITCH, and CONVENIENCE OUTLET: Provide an LED luminaire with automatic "door activated" switch where indicated on the drawings. Provide outlets in all panels in accordance with the drawings. Receptacles shall be 120VAC, 20A. See Section 40 92 00 for additional information.

I. COLOR:

1. Exterior: ANSI 61 grey; NEMA Type 4X stainless steel unpainted with smooth, brushed finish.

2. Interior: White.

2.3 PANEL WIRING

A. INTERNAL WIRING:

1. Internal wiring shall be single conductor 90 degree C copper wire and UL listed for panel wiring. Wire size shall be in accordance with NEC.

2. Internal wiring shall be color coded as specified in Section 26 05 00.

B. WIRE MARKERS: Wire markers shall comply with the requirements specified in Section 26 05 00.

C. WIRING METHODS:

1. Plastic wireway with covers shall be used to route groups of wires. Wireway fill shall be sized to provide 40% maximum fill. Plastic spiral wrap shall be used for exposed wires.

2. Wires that cross door hinges shall be enclosed in plastic spiral wrap.

D. FAIL-SAFE WIRING: Provide fail-safe wiring of control relay or other on/off device or instrument to ensure that upon loss-of-power or internal failure in the device, the relay is de-energized and the control relay contact operation provides for equipment failing in a safe mode.

2.4 ALARM AND TROUBLE DETECTION

A. The equipment control system shall incorporate a non-energized, open-state, output contact to activate on an alarm or trouble condition or on loss-of-power. Detection of a critical alarm or trouble condition shall cause the control system to initiate the shutdown or the operation of the equipment's con- trolled components to achieve a "Fail-Safe" condition.

B. Devices that signal an alarm or a trouble conditions shall latch in the alarm position and require a manual reset at the equipment control panel.

C. Alarm and trouble output shall:

1. Open an output dry-contact rated at 120 VAC at 2 amps.

2. Remain open until manually reset.

3. Not indicate abnormal condition when the equipment shutdown manually or automatically.

4. Indicate the alarm at the equipment control panel.

D. Fail-Safe Design and Operation:

1. Failure of part of a system shall not result in the failure of the rest of the system.

2. Failure of equipment or process shall not propagate beyond the failing device or equipment component.

3. Control design and operation shall prevent improper system functioning due to a circuit malfunction or operator error.

4. Control system design shall cause the controlled equipment to operate in a safe mode in the event of loss-of-power or the failure of a control system component.

2.5 CONTROL DEVICES

A. Control devices shall comply with appropriate sections of Division 40.

2.6 INDICATING LIGHTS

A. Indicating lights shall be equipped with colored lenses as specified in Section 26 05 00, and comply with appropriate sections of Division 40.

2.7 SURGE PROTECTION

A. Surge protectors shall be provided at panel external terminal blocks signal circuits which extend to field devices. Surge protectors shall be Joslyn Model 1663-08, Taylor 1020FA, Transtector, or equal.

2.8 TERMINAL BLOCKS

A. Terminal blocks shall be provided in accordance with Section 26 05 00 and Section 26 09 16. The terminal block assembly shall be mounted on channel standoffs. Provide 15 percent, but no less than 8, spare terminals available for future use.

2.9 LABELING AND NAMEPLATES

A. LABELING:

1. Panel components shall be labeled to match the description on the elementary diagram. Internal components of the panel on the back side of the door shall be labeled with the same description as provided on the front side.

2. Labeling shall be permanently marked on or near each component. Plastic embossed labels such as “Dymo” tape will not be accepted.

B. NAMEPLATES: External door-mounted components and the panel description shall be identified with plastic nameplates provided in accordance with Section 26 05 00

2.10 GROUNDING

A. Panels shall be provided with two copper ground bars.

B. One bar bonded to the panel frame and to the station ground system, typically located in the power section.

C. Second (signal) ground bar mounted on insulated stand-offs and bonded to the frame ground bar at one point only, typically located in the control section and bonded to the signal ground bar:

1. Signal circuits
2. Signal cable shields
3. Low-voltage direct current (24Vdc) power supply commons

D. Surge protectors and separately derived AC power supplies, such as 120Vac receptacles, shall be bonded to the frame ground bar. In panel line-ups exceeding 30- inches width, ground bars shall be 1/4- by 1-inch copper bars extending the entire length of the panel.

E. Neutrals of locally derived control circuits shall be grounded to the mounting plate using a copper bus or grounding lug.

F. Provide a grounding lug for a size No. 2 AWG bare copper conductor to connect the panel to the facility ground grid system.

PART 3 EXECUTION

3.1 GENERAL

A. Field verify the following:

1. Panel control circuits grounded with one terminal of each load device connected to the grounded conductor.

2. Panel signal and control wiring separated and installed in separate wireways with barriers between the power wiring and the signal and control wiring.

3. Panel connected to the plant grounding system as specified.

4. Panel tops of wall-mounted panels shall be mounted at the same elevation.

5. Panel inner door contains a copy of the record elementary and wiring diagrams.

6. Panel inner door contains a drawing holder.

7. Panel drawings enclosed in a transparent, protective jacket.

8. Panel functions as specified.

9. Panel mounted with stainless steel uni-strut, fittings, and fasteners.

3.2 DESIGN AND FABRICATION

A. CONTROL CABINETS:

1. Install PLC I/O card to terminal interface wiring with pre-manufactured, multi-conductor or bundled wire.

2. Install terminals on 2” standoffs.

3. Terminals shall be installed to allow a minimum of 2” of clear space between the terminal and the wireway or any other components.

4. Coordinate terminals and wireway locations to account for the location of the conduit entrances into the cabinet (example: if the majority of the wiring is coming into the bottom of the cabinet, then mount the terminals at the bottom of the cabinet).

5. Provide separate wire ways for internal and field wiring.

6. Provide space at the bottom of the cabinet for the UPS if applicable.

7. Provide right angle connectors on cables if the cable connection prevents closing of access doors on equipment within the cabinet or on the control cabinet itself.

3.3 MOUNTING

A. 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.

B. 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.

C. Steel used for support of equipment shall be Type 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.

D. Floor-mounted cabinets, except in dry control rooms or electrical equipment rooms, shall be mounted on 3-1/2-inch minimum height concrete pads or grouted bases as specified.

E. 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.

F. Terminals and terminal blocks shall be sprayed with a silicone resin similar to Dow Corning R-4-3117 conformal coating, after all terminations and testing have been completed.

3.4 FACTORY TESTING

A. The control panel shall be assembled, interconnected, and functionally tested at the assembly shop prior to shipment.

B. The OWNER shall have the option of witnessing the functional shop test. The CONTRACTOR shall notify the OWNER at least two weeks in advance prior of the scheduled functional shop test.

3.5 FIELD TESTING

A. Panels shall be tested in accordance with Section 40 91 00.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Execution.

1.2 SCOPE

A. This Section specifies general use wiring devices consisting of receptacles, plugs, switches and appurtenances. Also covered in this section are plugs and receptacles used for motor disconnecting or isolation means. See also 26 28 16.16 for enclosed disconnect switches.

1.3 REFERENCE STANDARDS

A. 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.

1. 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
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NEMA WD-1	General Requirements for Wiring Devices
NEMA WD-6	Wiring Devices - Dimensional
NFPA 70	National Electrical Code (NEC)
UL 20	General-Use Snap Switches
UL 498	Attachment Plugs and Receptacles
UL 514A	Metallic Outlet Boxes
UL 943	Ground-Fault Circuit Interrupters
UL 1010	Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

   a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

   b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

   b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

   c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

   d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

PART 2 PRODUCTS

2.1 GENERAL

A. Wiring devices shall be UL approved for the current and voltage specified and shall comply with NEMA WD-1. Devices shall contain provisions for back wiring and side wiring with captive binding screws.

B. Provide devices colored to conform to manufacturer's or industry standard for special use such as orange for isolated ground receptacles, blue for surge suppression receptacles, and red for emergency power receptacles. Unless shown otherwise on the Drawings or Schedules, normal use devices shall be grey.

2.2 RECEPTACLES AND PLUGS

A. GENERAL: Receptacles shall be ground fault interrupting type.

B. 120V RECEPTACLES:

1. INDOOR GROUND FAULT CURRENT INTERRUPTING: receptacle shall be duplex, 20 ampere, NEMA 5-20R and shall accept NEMA 5-15P and 5-20P plugs. Receptacle shall have LED indication of device fault and tripped condition. Receptacles shall meet the 2006 UL 943 standard for surge testing (3kA, 6kV) and requirement for "no power to face when miswired."

a. Manufacturers: Hubbell GFRST20 or Owner accepted substitute.

b. Receptacles shall be grey with chrome faceplate.

c. Receptacles shall be mounted in existing backboxes and provided with new faceplates as required.

d. Receptacles replaced in locations susceptible to splashing water or water pipe breakage (lower pump room area's) are to include expandable weatherproof in-use cover.

C. THREE PHASE RECEPTACLES AND PLUGS: Receptacles shall be suitable for 480 volt, 3-phase, 4-wire service, with ampere ratings as specified. Receptacles and plugs shall be designed so that the grounding pole is permanently connected to the housing. The grounding pole shall make contact before the line poles are engaged when the plug is connected to the receptacle housing. The plug sleeve shall also make contact with the receptacle housing before the line and load poles make contact. Receptacles shall be provided complete with cast back box, angle adapter, gaskets, and a gasketed screw-type, weather tight cap with chain fastener. Each receptacle shall be provided with one plug.

1. Plugs and receptacles used for motor disconnecting and isolating means must be approved for such use.

a. Non-metallic IP66/67 and NEMA 4X rated. Poly

b. Disconnect rated.

c. Provide units with current and HP ratings as required.

d. Receptacles to include dead front shutter that deploys automatically when receptacle is removed.

e. Plugs to be provided with spring assisted latching mechanism to secure in place when plugged into matching receptacle.

1) Latching mechanism to include quick release button.

f. Provide with two auxiliary / pilot contacts rated for 1.5 amps at 480 VAC.

1) Where shown on the drawings or required by specific equipment, provide additional pilot contacts as required and as available within the product line.

2. Manufacturers: Meltric "DSN" series approved equal.

2.3 SWITCHES

A. GENERAL PURPOSE: General purpose switches shall be rocker type, quiet AC type, specification grade, back and side wired, and shall be provided in accordance with rated capacities as required or as indicated on Drawings or Schedules. Switches shall match receptacles in color. Voltage and current ratings shall be 120VAC, 20-ampere.

1. Manufacturers: General Electric, Hubbell, or Owner accepted substitute.

2.4 DEVICE PLATES

A. RECEPTACLES AND SWITCHES:

1. Indoor device plates shall be made of sheet steel, zinc electroplated with chrome finish as manufactured by Hubbell, Crouse-Hinds, Appleton, or approved equal.

2. In areas susceptible to splashing water; receptacle covers shall provide while-in-use protection, rated NEMA 3R with cover closed. Covers shall be expandable polycarbonate as manufactured by Hubbell/Taymac ML500G or approved equal.

B. Device plates shall be provided with engraved laminated phenolic nameplates with 1/8-inch white characters on black background.

1. Nameplates for switches shall identify panel and circuit number and area served (if remotely switched).

2. Nameplates for receptacles shall identify circuit and voltage if other than 120 volts, single phase.

PART 3 EXECUTION

3.1 GENERAL

A. Boxes shall be independently supported by galvanized brackets, expansion bolts, toggle bolts, or machine or wood screws as appropriate. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure boxes, nor shall welding or brazing be used for attachment.

B. Receptacles and switches installed in sheet steel boxes shall be flush mounted. Flush mounted receptacles shall be located 18 inches above the floor unless otherwise indicated. Switch boxes shall be mounted 48 inches above the floor. Receptacles installed in cast device boxes shall be located 48 inches above the floor.

C. Wiring devices shall be tested for correct connections.

END OF SECTION

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SECTION 26 28 13 - FUSES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Definitions
5. Submittals.
6. Coordination.
7. Products.
8. Execution.

1.2 SCOPE

A. This section includes cartridge fuses, rated 600V and less, for use in switches, panelboards, switchboards, controllers, and motor-control centers; and spare fuse cabinets.

1.3 REFERENCE STANDARDS

A. NEMA FU1 (National Electrical Manufacturers Association) - Low Voltage Cartridge Fuses.

B. NETA ATS (National Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

C. NFPA 70 (National Fire Protection Association) - National Electrical Code.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment first start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 DEFINITIONS

A. RMS: Root mean square.
B. SPDT: Single pole, double throw.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Product Data: For each fuse type indicated:

    a. Ambient Temperature Adjustment Information: If rating of fuses has been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

        1) For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature and adjusted fuse rating.

        2) Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

    b. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

    c. Let-through current curves for fuses with current-limiting characteristics.

    d. Time-current coordination curves and current-limitation curves for each type and rating of fuse. Coordination charts and tables, and related data.

4. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

1.7 COORDINATION

A. Coordinate fuse ratings with all equipment nameplate limitations of maximum fuse size.

B. Select fuses to provide appropriate levels of short circuit and overcurrent protection for components such as wire and cable, bus structures, and other overcurrent equipment.

C. Select fuses to coordinate with time-current characteristics of other overcurrent protective elements, such as other fuses, circuit breakers, and protective relays. Design system to ensure that device closest to fault operates first.

D. The Engineer shall verify that the let-through current of the selected fuse does not exceed the rating of downstream devices or conductors. The Engineer shall calculate the short-circuit capability of downstream cable to verify that it is protected by the fuse time-current characteristic curve.

E. The Engineer shall selectively coordinate all protective devices so faults are isolated to the most localized level.

1. On low voltage systems this may occasionally indicate the use of a fuse in series with a circuit breaker.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bussmann; Division of Cooper Industries.
2. Mersen.
3. Littelfuse.
4. Or Approved Equal.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, non-renewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.3 LOW-VOLTAGE FUSES

A. Fuses for circuits under 600V shall be UL listed, Class J, Class L, Class R or RK.

B. Fuses for safety switches shall be class R, intended for use with rejection clips.

1. Use Class L and Class T fuses to protect loads over 600 Amps such as transformer secondaries, switchboard mains or large feeders

2. Use Class J, Class K and Class R fuses to protect most feeder and branch-circuit applications.

C. Fuse Applications:

1. Main Services and Main Feeders

a. 601 to 6000A circuits: Provide Class L with 4-second minimum time delay at 500% rated current, with an interrupting rating of 200,000 amperes RMS symmetrical.

b. 600 amperes and less circuits: Provide Class RK1 dual-element, time-delay, non-interchangeable fuses with an interrupting rating of 200,000 amperes, for 600 volt and 250-volt applications, respectively.

c. 600-volt RK1 fuses shall have an indicating feature, which clearly indicates when fuse is opened (blown).

2. Motor Circuit Fuses: Provide Class RK1 and Class J dual-element time-delay fuses with 10-second minimum time delay at 500% rated current, sized at 125% of full-load current of motor.

3. VFD Circuit Fuses: Provide Class J high-speed current-limiting fuses or as recommended per manufacturer's.

4. Current limiting fuses Protecting Molded-Case Circuit Breaker Panelboards

a. Molded case circuit breaker panelboards, having short-circuit ratings less than the available short-circuit current at the point where the panelboard is applied, shall be protected by Class and maximum fuse ratings listed by the panelboard manufacturer.

b. Class G (300V) and Class CC (600V) current limiting, noninterchangeable, time delay or non-time delay fuses are used in branch-circuit panelboards.

5. Lighting Fixture Protection

a. Lighting fixture ballasts shall be individually protected on their line.

b. In each instance, fuse size and type shall be as recommended by the fixture or ballast manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Main Services and Main Feeders:

1. 601A to 6000A circuits: Class L, minimum 4 second time delay at 500% rated current, with an interrupting rating of 200,000 amperes RMS symmetrical.

2. 600A and less circuits: Class RK1 dual-element, time delay, non-interchangeable fuses with an interrupting rating of 200,000 amperes, for 600V and 250V applications.

a. 600V RK1 fuses shall have an indicating feature which clearly indicates when fuse is opened (blown).

B. Motor Branch Circuits: Class RK1 and Class J dual element time-delay fuses with 10-second minimum time delay at 500% rated current, sized at 125% of full load current of motor.

C. Current Limiting Fuses Protecting Molded Case Circuit Breaker Panelboards:

1. Molded case circuit breaker panelboards having short circuit ratings less than the available short circuit current at the point where the panelboard is applied shall be protected by Class and maximum fuse ratings listed by the panelboard manufacturer.

2. Class G (300V) and Class CC (600V) current limiting, non-interchangeable time delay or non-time delay fuses are used in branch circuit panelboards.

D. Light Fixture Protection:

1. Luminaire ballasts shall be individually protected on their line.

2. In each instance, fuse size and type shall be as recommended by the fixture or ballast manufacturer.

3.3 FUSE INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so that manufacturer, type and rating information is readable without removing fuse. Do not mix brands of types of fuses in device.

B. The Electrical CONTRACTOR at the job site shall install all fuses only when equipment is to be energized. Fuses shall not be installed prior to shipment.

C. Install spare fuse cabinet[s]. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

END OF SECTION

SECTION 26 28 16.13 - ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Definitions
5. Submittals.
6. Coordination.
7. Products.
8. Execution.

1.2 SCOPE

A. This section includes individually mounted enclosed switches and circuit breakers used for the following:

1. Service disconnecting means.
2. Feeder and branch-circuit protection.
3. Motor and equipment disconnecting means.

1.3 REFERENCE STANDARDS

A. NEMA AB 1 (National Electrical Manufacturers Association) - Molded Case Circuit Breakers.

B. NEMA FU1 (National Electrical Manufacturers Association) - Low Voltage Cartridge Fuses.

C. NEMA KS 1 (National Electrical Manufacturers Association) - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

D. NETA ATS (National Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

E. NFPA 70 (National Fire Protection Association) - National Electrical Code.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment first start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.
B. RMS: Root mean square.
C. SPDT: Single pole, double throw.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

   a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

   b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

4. Field Test Reports: Submit written test reports and include the following:

   a. Test procedures used.

   b. Test results that comply with requirements.

   c. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

5. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1 General Requirements. In addition to requirements specified in Section 01 77 00 - Project Closeout include the following:

   a. Routine maintenance requirements for components.

b. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.

c. Time-current curves, including selectable ranges for each type of circuit breaker.

6. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

   b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

   c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

   d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

7. Shop Drawings: For each switch and circuit breaker.

   a. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

      1) Enclosure types and details for types other than NEMA 250, Type 1.

      2) Current and voltage ratings.

      3) Short-circuit current rating.

      4) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

      5) Include time-current coordination curves for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

8. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches, accessories, and components will withstand seismic forces defined in Section 01 61 10.

   a. Basis of Certification: Verify whether withstand certification is based on actual test of assembled components.

1) The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 DELIVERY, STORAGE AND HANDLING

A. PROCEDURES: Section 00 72 00 General Conditions

B. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

C. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer’s recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric.
3. Group Schneider/Square D
4. Siemens.
5. Or Approved Equal.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Enclosed Circuit Breakers

1. Ground Fault protection type:

a. Required for solidly grounded wye service entrance switches over 150 Volts to ground, not exceeding 600 Volts and rated 1000 Amps and above.

2. Auxiliary contacts: Provide as required by engineering considerations.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long and short-time pickup levels.
   c. Long and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.

6. GFCI Circuit Breakers: Single- and two-pole configurations with 5 mA or 30 mA trip sensitivity.

7. Molded-Case Switch: Molded-case circuit breaker without trip units.

C. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

4. Communication Capability: Circuit-breaker-mounted, Integral communication module with functions and features compatible with power monitoring and control system.

5. Shunt Trip: 120V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

6. Auxiliary Switch: Two SPDT switches with “a” and “b” contacts; “a” contacts mimic circuit-breaker contacts, “b” contacts operate in reverse of circuit-breaker contacts.

7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

8. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

D. Service Entrance: For enclosed circuit breakers identified for use as service equipment, provide solid neutral assembly and equipment ground bus.

2.3 ENCLOSURES

A. NEMA AB 1, NEMA KS 1 and UL 50 to meet environmental conditions of installed location.

1. Indoor Clean Locations: NEMA 250, Type 1.

2. Indoor Dusty Locations: NEMA 250, Type 12.

3. Indoor Wet or Damp Locations and Outdoor Dirty/Oily or Washdown Locations: NEMA 250, Type 4.

4. Outdoor Locations: NEMA 250, Type 3R.

5. Corrosive Locations: NEMA 250, Type 4X, stainless steel.

6. Hazardous Areas Indicated on Drawings: NEMA 250, Type [7] [8] [9].

2.4 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and tested enclosures before shipping.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 70 working space requirements and NECA 1.

B. Standard Mounting Height: Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated. Operating handle typically at 5'-0" above grade or finished floor.

C. Mount on substantial structure and secure to meet seismic zone 3 requirements. Comply with mounting and anchoring requirements specified in Section 01 61 10 - Seismic Requirements for Non-Structural Components and Systems.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses with rating indications facing outward.

F. Set adjustable parameters and provide testing and calibration as required by engineering considerations.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 26 05 53 - Electrical Identification.

B. Install enclosure nameplate with switch or circuit breaker designation, power source, source location, voltage, load served and load location.

1. Identify special conditions for shutting down load served.

C. Apply label inside door cover identifying NEMA fuse class and size of fuses installed.

D. Equipment used in emergency systems shall be labeled “Suitable for use on emergency systems” per NEC 700-3.

3.4 CONNECTIONS

A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.

B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.

C. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

1. Mark lugs after torqueing with red paint such that paint will be visibly disturbed if lugs are disturbed.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to initially inspect, test, and adjust components, assemblies, and equipment installations, including connections. Verification will be by third party testing agency.

B. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.

2. Test continuity of each line- and load-side circuit.

C. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.8 OPERATION AND MAINTENANCE MANUALS

A. Comply with Section 01 78 23.13 - Operations and Maintenance Data and Part 1 of this specification.

END OF SECTION

SECTION 26 28 16.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Definitions
5. Submittals.
6. Coordination.
7. Products.
8. Execution.

1.2 SCOPE

A. This section includes individually mounted enclosed switches and circuit breakers used for the following:

1. Service disconnecting means.
2. Feeder and branch-circuit protection.
3. Motor and equipment disconnecting means.

1.3 REFERENCE STANDARDS

A. NEMA AB 1 (National Electrical Manufacturers Association) - Molded Case Circuit Breakers.

B. NEMA FU1 (National Electrical Manufacturers Association) - Low Voltage Cartridge Fuses.

C. NEMA KS 1 (National Electrical Manufacturers Association) - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

D. NETA ATS (National Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

E. NFPA 70 (National Fire Protection Association) - National Electrical Code.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment first start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 DEFINITIONS

A. RMS: Root mean square.
B. SPDT: Single pole, double throw.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

   a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

   b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

   b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

4. Shop Drawings: For each switch and circuit breaker.

   a. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

      1) Enclosure types and details for types other than NEMA 250, Type 1.

      2) Current and voltage ratings.

3) Short-circuit current rating.

4) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

5) Include time-current coordination curves for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

b. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

c. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

5. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches, accessories, and components will withstand seismic forces defined in Section 01 61 10.

a. Basis of Certification: Verify whether withstand certification is based on actual test of assembled components.

1) The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

6. Field Test Reports: Submit written test reports and include the following:

a. Test procedures used.

b. Test results that comply with requirements.

c. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

7. Manufacturer’s field service report.

8. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1 General Requirements. In addition to requirements specified in Division 1, include the following:

a. Routine maintenance requirements for components.

b. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.

c. Time-current curves, including selectable ranges for each type of circuit breaker.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric.
3. Group Schneider/Square D
4. Siemens.
5. Or Approved Equal.

2.2 ENCLOSED SWITCHES

A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.

B. Enclosed, Fusible Switch, 800A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handles with two padlocks, and interlocked with cover in closed position.

C. Service Entrance: For switches identified for use as service equipment, provide solid neutral assembly and equipment ground bus.

2.3 ENCLOSURES

A. NEMA AB 1, NEMA KS 1 and UL 50 to meet environmental conditions of installed location.

1. Indoor Clean Locations: NEMA 250, Type 1.

2. Indoor Dusty Locations: NEMA 250, Type 12.

3. Indoor Wet or Damp Locations and Outdoor Dirty/Oily or Washdown Locations: NEMA 250, Type 4.

4. Outdoor Locations: NEMA 250, Type 3R.

5. Corrosive Locations: NEMA 250, Type 4X, stainless steel.

6. Hazardous Areas Indicated on Drawings: NEMA 250, Type [7] [8] [9].

2.4 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and tested enclosures before shipping.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 70 working space requirements and NECA 1.

B. Standard Mounting Height: Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated. Operating handle typically at 5'-0" above grade or finished floor.

C. Mount on substantial structure and secure to meet seismic zone 3 requirements.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses with rating indications facing outward.

F. Set adjustable parameters and provide testing and calibration as required by engineering considerations.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 26 05 53 - Electrical Identification.

B. Install enclosure nameplate with switch or circuit breaker designation, power source, source location, voltage, load served and load location.

1. Identify special conditions for shutting down load served.

C. Apply label inside door cover identifying NEMA fuse class and size of fuses installed.

D. Equipment used in emergency systems shall be labeled "Suitable for use on emergency systems" per NEC 700-3.

3.4 CONNECTIONS

A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.

B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

1. Mark lugs after torqueing with red paint such that paint will be visibly disturbed if lugs are disturbed.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to initially inspect, test, and adjust components, assemblies, and equipment installations, including connections. Verification will be by third party testing agency.

B. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.

2. Test continuity of each line- and load-side circuit.

C. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 26 29 13.13

ACROSS-THE-LINE MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Execution.

1.2 SCOPE

A. The extent and location of "Motor Controllers" Work is shown in the Contract Documents. This section includes motor controllers rated 600V and less that are supplied as enclosed units.

1.3 REFERENCE STANDARDS

A. IEEE C62.41 (Institute of Electrical and Electronics Engineers) - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. UL 489 - Molded Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

C. NEMA FU 1 (National Electrical Manufacturers Association) – Low Voltage Cartridge Fuses.

D. NEMA ICS 2 (National Electrical Manufacturers Association) - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

E. NEMA ICS 3 (National Electrical Manufacturers Association) - Industrial Control and Systems: Factory Built Assemblies.

F. NEMA ICS 5 (National Electrical Manufacturers Association) - Industrial Control and Systems: Control Circuit and Pilot Devices.

G. NEMA KS 1 (National Electrical Manufacturers Association) – Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

H. NETA ATS (National Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

I. NFPA 70 (National Fire Protection Association) - National Electrical Code.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for electrical work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from the date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

   a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

   b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Shop Drawings: For each motor controller.

a. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

1) Enclosure types and details.

2) Factory-installed devices.

3) Nameplate legends.

4) Short-circuit current rating of integrated unit.

5) UL listing for series rating of overcurrent protective devices in combination controllers.

6) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.

b. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

4. Field Test Reports: Written reports specified in Part 3.

5. Manufacturer's field service report.

6. Maintenance Data: For enclosed controllers and components to include in maintenance manuals specified in Division 1 General Requirements. In addition to requirements specified in Section 01 78 23.13 - Operations and Maintenance Data include the following:

a. Parts list.

b. Wiring schematics/diagrams and heater tables.

c. Routine maintenance requirements for enclosed controllers and all installed components.

d. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

7. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Source Limitations: Obtain controllers of a single type through one source from a single manufacturer in service for at least 10 years.

C. Listing and Labeling: Provide components, devices and accessories that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for intended use for the location and environment in which they are installed.

D. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, including clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.8 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

C. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, unless specified otherwise on the drawings:

1. ABB

2. Allen-Bradley
3. Eaton
4. General Electric
5. Group Schneider/Square D
6. Siemens
7. Or Approved Equal.

2.2 ENCLOSURES

A. NEMA ICS 6, Type to meet environmental conditions at installed location:

1. Indoor Clean, Dry Locations: NEMA 250, Type 1.
2. Indoor Locations Subject to Wet or Dry Contaminants: NEMA 250, Type 12.
3. Outdoor or Damp Locations: NEMA 250, Type [3R] [4].
4. Corrosive Locations: NEMA 250, Type 4X, stainless steel.
5. Hazardous Locations: NEMA 250, Type 7 to meet NFPA hazardous classification.

2.3 GENERAL

A. Provide reduced-voltage starters for centrifugal horsepower sizes for voltages and sizes as noted below or as show on the drawings:

1. 5 HP and larger - 208V, 3-phase
2. 5 HP and larger - 480V, 3-phase

B. Positive displacement loads shall have reduced voltage starters

2.4 STARTING METHODS MAY INCLUDE, BUT ARE NOT LIMITED, TO THE FOLLOWING

A. Manual
B. Magnetic Full Voltage Non-reversing (FVNR)
C. Magnetic Full Voltage reversing (FVR)
D. Solid-state soft start with integral bypass contactor

2.5 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Configuration: Nonreversing OR Reversing OR Two speed.

2. Pilot Light:

a. Mounted in front of panel.
b. Red indicates “running”.
c. Green indicates “ready”.
d. Standard pilot lights are 120V, transformer type, push-to-test.

3. Additional Nameplates: FORWARD and REVERSE for reversing switches, HIGH and LOW for two-speed switches.

C. Fractional Horsepower Single Phase Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Configuration: Nonreversing OR Two speed.

2. Lockout means required in all applications.

3. Fault duty to meet available fault current.

4. Interchangeable overload heater elements.

5. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type or melting alloy type.

6. Red pilot light to indicate “running.”

7. Additional Nameplates: HIGH and LOW for two-speed controllers.

D. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Configuration: Nonreversing, reversing or two speed, depending on engineering considerations.

2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button; bimetallic type or melting alloy type.

3. Red and Green pilot light.

4. Additional Nameplates: FORWARD and REVERSE for reversing controllers OR HIGH and LOW for two-speed controllers.

5. One each N.O. and N.C. reversible auxiliary contact.

E. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Configuration: Nonreversing OR reversing, based on engineering considerations.

2. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

4. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

    a. CPT Spare Capacity: Size CPT at least one size above minimum VA requirements.

5. Melting Alloy Overload Relays:

    a. Inverse-time-current characteristic.

    b. Class 10 tripping characteristic.

    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

6. Bimetallic Overload Relays:

    a. Inverse-time-current characteristic.

    b. Class 10 tripping characteristic.

    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

    d. Ambient compensated where required by engineering requirements.

    e. Automatic resetting.

7. Solid-State Overload Relay:

    a. Switch or dial selectable for motor running overload protection. Software selectable is not acceptable.

    b. Sensors in each phase.

    c. Class 10 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.

e. IP addressable communication module.

8. One each N.C. and N.O. reversible isolated overload alarm contact.

9. External overload reset push button.

F. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Sizes 1 through 5 are standard for all applications.

2. Motor controller preferred features include:

a. Current sensor/microprocessor-type overload protection with adjustable parameters including overcurrent, ground fault, phase loss, phase unbalance, undervoltage and overvoltage.

b. Melting alloy or bimetallic strip type overload relays with ambient compensated inverse time-current characteristics are acceptable.

c. Control pushbuttons, industrial oil-tight type.

d. Push-to-test pilot lights.

3. Fusible Disconnecting Means:

a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.

b. Lockable Handle: Accepts 3/8-inch hasp padlocks and interlocks with cover in closed position.

c. Auxiliary Contacts: Minimum two N.O./N.C. reversible contacts, arranged to activate before switch blades open.

4. Nonfusible Disconnecting Means:

a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.

b. Lockable Handle: Accepts 3/8-inch hasp padlocks and interlocks with cover in closed position.

c. Auxiliary Contacts: Minimum two N.O./N.C. reversible contacts, arranged to activate before switch blades open.

5. MCP Disconnecting Means:

    a. Use where available fault current is 65,000 Amps symmetrical or less.

    b. UL 489, UL 489, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable up to 1300% of motor FLA, short-circuit trip coordinated with motor locked-rotor amperes.

    c. Lockable Handle: Accepts 3/8-inch hasp padlocks and interlocks with cover in closed position.

6. MCCB Disconnecting Means:

    a. Use where available fault current exceeds 65,000 AIC.

    b. UL 489, UL 489, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.

    c. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

    d. Lockable Handle: Accepts 3/8-inch hasp padlocks and interlocks with cover in closed position.

2.6 REDUCED-VOLTAGE SOLID-STATE CONTROLLERS

A. General Requirements for Reduced-Voltage Solid-State Controllers: Comply with UL 508.

B. For operational, troubleshooting and spare parts replacement, the soft starter shall be an ABB PSE series as shown on the drawings.

C. Reduced-Voltage Solid-State Controllers: An integrated unit with power semiconductors, heat sink, microprocessor logic board, door-mounted digital display and keypad, bypass contactor, and overload relay; suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.

    1. Configuration: Heavy duty, reversible OR non-reversible, depending on engineering considerations.

    2. Starting Mode: Voltage ramping OR Current limit OR Torque control OR Torque control with voltage boost OR; field selectable, depending on application.

3. Stopping Mode: Coast to stop OR Adjustable torque deceleration OR Adjustable braking OR field selectable, depending on application.

4. Shorting (Bypass) Contactor: Operates automatically when full voltage is applied to motor, and bypasses the power semiconductors. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.

5. Shorting and Input Isolation Contactor Coils, if required by project parameters: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating. Provide coil transient suppressors.

6. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.

7. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

    a. CPT Spare Capacity: Size CPT at least one size above minimum VA requirements.

8. Adjustable acceleration-rate control using voltage or current ramp, and adjustable starting torque control with up to 400 percent current limitation for 20 seconds.

9. Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:

    a. Adjusting motor full-load amperes, as a percentage of the controller's rating.

    b. Adjusting current limitation on starting, as a percentage of the motor full-load current rating.

    c. Adjusting linear acceleration and deceleration ramps, in seconds.

    d. Initial torque, as a percentage of the nominal motor torque.

    e. Adjusting torque limit, as a percentage of the nominal motor torque.

    f. Adjusting maximum start time, in seconds.

    g. Adjusting voltage boost, as a percentage of the nominal supply voltage.

    h. Selecting stopping mode, and adjusting parameters.

    i. Selecting motor thermal overload protection class between 5 and 30.

j. Activating and de-activating protection modes.

10. Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:

    a. Controller Condition: Ready, starting, running, stopping.

    b. Motor Condition: Amperes, voltage, power factor, power, and thermal state.

    c. Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor underload, overcurrent, shorted power semiconductors, line or phase loss, phase reversal, and line frequency over or under normal.

11. Controller Diagnostics and Protection:

    a. Microprocessor-based thermal protection system for monitoring power semiconductor and motor thermal characteristics, and providing controller overtemperature and motor-overload alarm and trip; settings selectable via the keypad.

    b. Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and underload conditions; and line frequency over or under normal.

    c. For controllers without integral disconnects, provide input isolation contactor that opens when the controller diagnostics detect a faulted solid-state component or when the motor is stopped.

    d. For combination motor starter/disconnect, provide shunt trip that opens the disconnecting means when the controller diagnostics detect a faulted solid-state component.

12. Remote Output Features:

    a. All outputs prewired to terminal blocks.
    b. Form C status contacts that change state when controller is running.
    c. Form C alarm contacts that change state when a fault condition occurs.

13. Optional Features:

    a. Analog output for field-selectable assignment of motor operating characteristics; 4 to 20-mA dc.

    b. Additional field-assignable Form C contacts, as indicated, for alarm outputs.

c. Surge suppressors in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.

d. Melting Alloy Overload Relays:

1) Inverse-time-current characteristic.

2) Class 10 tripping characteristic.

3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

e. Bimetallic Overload Relays:

1) Inverse-time-current characteristic.

2) Class 10 tripping characteristic.

3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

4) Ambient compensated.

f. Solid-State Overload Relay:

1) Switch or dial selectable for motor running overload protection. Software selectable controls are not allowed.

2) Sensors in each phase.

3) Class 10 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.

5) IP addressable communication module.

g. One each N.C. and N.O. reversible, isolated overload alarm contact.

h. External overload reset push button

14. Integral bypass contactor.

D. Combination Reduced-Voltage Solid-State Controller: Factory-assembled combination of reduced-voltage solid-state controller, OCPD, and disconnecting means.

1. Fusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.

    b. Lockable Handle: Accepts 3/8-inch hasp padlocks and interlocks with cover in closed position.

    c. Auxiliary Contacts: Minimum two N.O./N.C. reversible contacts, arranged to activate before switch blades open.

2. MCP Disconnecting Means:

    a. Use where available fault current is 65,000 Amps symmetrical or less.

    b. UL 489, UL 489, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable up to 1300% of motor FLA, short-circuit trip coordinated with motor locked-rotor amperes.

    c. Lockable Handle: Accepts 3/8-inch hasp padlocks and interlocks with cover in closed position.

3. MCCB Disconnecting Means:

    a. Use where available fault current exceeds 65,000 Amps symmetrical.

    b. UL 489, UL 489, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.

    c. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

    d. Lockable Handle: Accepts 3/8-inch hasp padlocks and interlocks with cover in closed position.

4. Molded-Case Switch Disconnecting Means:

    a. UL 489, UL 489, and NEMA AB 3, with in-line fuse block for Class J or L power fuses (depending on ampere rating), providing an interrupting capacity to comply with available fault currents; MCCB with fixed, high-set instantaneous trip only.

b. Lockable Handle: Accepts 3/8-inch hasp padlocks and interlocks with cover in closed position.

2.7 VARIABLE-FREQUENCY CONTROLLERS

A. Refer to Section 26 29 23 - Variable Frequency Controllers.

2.8 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Push-Buttons, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty, industrial oil-tight type.

1. Push Buttons: 120V, 20A, industrial grade, nylon, NEMA 13.

2. Pilot Lights: 120V LED transformer types, red “running” and green “ready”, push to test, mounted in front panel of each module.

3. Selector Switches: Rotary hand-off-auto mounted in front panel.

C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Elapsed Time Meters: Heavy duty with digital readout in hours.

F. Meters: Panel type, 2-1/2-inch minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.

G. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays as required by engineering considerations: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.

H. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4 and Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

I. Space heaters, with N.C. auxiliary contacts, to mitigate condensation in enclosures installed outdoors.

J. Spare control wiring terminal blocks, quantity as indicated; unwired.

K. Current-Sensing, Phase-Failure Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.9 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and tested enclosed controllers before shipping.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive enclosed controllers for compliance with working space requirements of NEC Article 110-26, installation tolerances, and other conditions affecting performance.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

3.3 CONTROLLER INSTALLATION

A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks.

B. Install freestanding equipment on concrete bases complying with Section 03 30 00 - Cast-in-Place Concrete.

C. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Section 26 28 13 – Fuses.

D. Floor-Mounted Controllers: Install enclosed controllers on 3-1/2 -inch nominal-thickness concrete base. Concrete shall be rated minimum 3000 psi.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

E. Seismic Bracing: Comply with requirements specified in Section 13 05 41 - Seismic Requirements for Non-Structural Components and Systems.

F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

G. For individual magnetic motor starters, provide an overcurrent protection and disconnect device ahead of controller. This device shall be in an enclosure with lockout means.

H. Torque all lugs per manufacturer's written recommendations. When manufacturer's recommendations are unavailable, use UL 486A and UL 486B for torque values.

1. Place a spot of red paint on lugs after torqueing such that paint will be visibly disturbed if lugs are disturbed.

I. Install fuses in each fusible-switch enclosed controller.

J. Install fuses in control circuits if not factory installed.

K. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

L. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

M. Install power factor correction capacitors. Connect to the line or load side of overload relays as required by project parameters. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.

N. Comply with NECA 1.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between motor-control devices according to Section 26 05 19 - 600 Volt or Less Wire and Cable.

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic-control devices where applicable.

1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.

2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3. Provide auxiliary switch operated by disconnect switch mechanism to remove all foreign control power when disconnect switch is open.

3.5 CONNECTIONS

A. Conduit installation requirements are specified in other Division 26 Electrical Sections. Drawings indicate general arrangement of raceways.

B. Ground equipment.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

1. Mark lugs after torqueing with red paint such that paint will be visibly disturbed if lugs are disturbed.

3.6 IDENTIFICATION

A. Identify enclosed controller components and control wiring according to Section 26 05 53 – Identification for Electrical Systems.

B. Label motor controller with engraved laminated-plastic nameplate with equipment designation, power source, source location, voltage/phase, load designation, location and horsepower.

C. Provide typed label inside motor controller door identifying motor nameplate horsepower, full-load amperes, code letter, service factor and voltage/phase rating.

D. Equipment used in emergency systems shall be labeled “Suitable for use on emergency systems” per NEC 700-3.

3.7 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including pre-testing and adjusting solid-state controllers.

B. Prepare for acceptance tests as follows:

1. Remove all blocking used for shipment.

2. Test insulation resistance for each motor controller component, connecting supply, feeder, and control circuit. Use a 500-Volt Megger for 208- and 240-Volt systems, and a 1000-Volt Megger for 480-Volt systems.

3. Test continuity of circuit and equipment ground.

4. Verify proper rating of overcurrent protective device.

5. Verify correct conductor color-coding.

6. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify the Engineer before starting the motor(s).

7. With motor disconnected, energize control circuit and test for correct functioning.

   a. Control switch test:

      1) Inspect all contacts and shunts. Clean contacts if required.

      2) Operate switch and note that all design functions are performed in proper sequence.

   b. Check all auxiliary contacts for correct arrangement with coil de-energized (normally open or normally closed).

8. Check all motor for proper phase rotation.

C. Testing: Perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection indicated in NETA ATS, Section 7.16.1.

2. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than two weeks prior to Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.

    b. Follow-up Infrared Scanning: The Port shall have the option of performing its own infrared scan.

3. Certify compliance with test parameters.

4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.8 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

B. Set motor circuit protectors as low as possible without causing nuisance tripping.

C. Set motor overloads per manufacturer's tables for actual motor nameplate full-load amperes.

1. Where motor controllers with CT/Microprocessor overloads are employed, set all adjustable parameters per Engineer's instructions.

D. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

E. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where

these maximum settings do not allow starting of a motor, notify the Engineer before increasing settings. If initial setting of six times the motor nameplate FLA rating does not cause tripping, adjust settings down so that setting is as low as possible without causing nuisance tripping.

F. Set the taps on reduced-voltage autotransformer controllers as required as part of field certification.

G. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.

H. Where motor controllers with CT/Microprocessor overloads are provided, set all adjustable parameters per Engineer's instructions.

I. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 – Power System Studies

3.9 CLEANING

A. Clean enclosed controllers internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.10 STARTUP SERVICE

A. Verify that enclosed controllers are installed and connected according to the Contract Documents.

B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Electrical Sections.

C. Complete installation and startup checks according to manufacturer's written instructions.

END OF SECTION

SECTION 26 29 23 – VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 DESCRIPTION

A. This specification is to cover a complete Variable Frequency Drive (VFD aka: VFD, AFD, ASD, Inverter, AC Drive, et al) consisting of a pulse width modulated (PWM) inverter designed for use with a standard AC induction motor, synchronous reluctance (SynRM) and permanent magnet (PM) motors in wastewater applications. The VFD must provide a V/Hz or sensor-less vector mode of operation.

B. The drive vendor shall supply the drive and all necessary options as specified VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable.

1.2 QUALITY ASSURANCE

A. Referenced Standards and Guidelines:

1. Institute of Electrical and Electronic Institute of Electrical and Electronic Engineers (IEEE)

    a. IEEE 519, Guide for Harmonic Content and Control.

2. Underwriters Laboratories (as appropriate)

    a. UL508C

    b. UL61800-5-1

3. National Electrical Manufacturer's Association (NEMA)

    a. ICS 7.0, AC Adjustable Speed Drives

4. International Electro-technical Commission (IEC)

    a. EN/IEC 61800-3

    b. 2014/35/EU Low Voltage Directive

    c. 2014/30/EU Electromagnetic compatibility (EMC)

    d. 2006/42/EC Machinery Directive

5. National Electric Code (NEC)

    a. NEC 430.120, Adjustable-Speed Drive Systems

6. International Building Code (IBC)

    a. IBC 2012 Seismic – referencing ASC 7-05 and ICC AC-156

B. Qualifications:

1. VFDs and options shall be UL508C listed. The ACQ580 standard VFD shall be UL labeled 100 kA SCCR, RMS Symmetrical, 600V max.

2. UL-APPROVAL the VFDs shall be available as UL compliant version which complies the technical regulations of UL according to UL61800-5-1. A UL listing document shall be available to confirm VFDs compliance with the requirements. Manufacturer's statements of UL compliance or pending approval are not accepted. The VFD shall comply the technical regulations of UL according to UL508C. UL listing document shall be available to confirm VFDs compliance with the requirements.

3. Environmental Manufacturing: The VFD shall comply with Restriction of Hazardous Substances in Electrical and Electronic Equipment directive 2011/65/EU requirements, so called RoHS II requirements. The VFD shall be easy to recycle. The manufacturer shall make recycling instructions publicly available. The recycling instructions shall provide recycling information in accordance to Waste Electrical and Electronic Equipment directive 2012/19/EU (WEEE).

4. Functional Safety:

    a. The VFDs shall support 'Safe Torque Off' (STO) function capable for safety related applications up to SIL 3, SIL_{CL} 3 and PL e.

    b. The VFD shall comply with the following standards

        1) IEC 61508:2010; SIL

        2) ISO 13849-1:2006; PL e

        3) IEC 62061:2005; SIL_{CL} 3

        4) IEC 61800-5-2:2007; SIL 3

1.3 SUBMITTALS

A. The Submittals shall be in accordance with 01 33 00 and include the following information at minimum:

1. Product Overview

2. Dimensional Shop Drawings

3. Control Circuit Drawings

4. Engineering Data including rating tables and weight

5. General Notes

1.4 DELIVERY, STORAGE AND HANDLING

A. PROCEDURES: Section 00 72 00 General Conditions

B. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

C. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES (VFD)

A. The VFD shall be solid state, with a Pulse Width Modulated (PWM) output. The VFD shall be a Sensor-less Vector AC to AC converter utilizing the latest Insulated Gate Bipolar Transistor (IGBT) technology. The VFD shall employ a Sensor-less Vector inner loop torque control strategy that mathematically determines motor torque and flux. The VFD must also provide an optional operational mode for V/Hz Operation.

B. For operational, troubleshooting and spare parts replacement, the VFD shall be an ABB ACQ580 series as shown on the drawings and to match other Owner facilities.

C. Ratings:

1. The VFD shall be rated to operate from 3-phase power at the voltage of 480 VAC +10%/-15%, 48Hz to 63Hz. The VFD shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.98 at all speeds and nominal load. The ACQ580 standard VFD efficiency shall be 98% or better at full speed and load.

2. An 480Vac 1-350 Hp VFD, shall have internal chokes (reactors) to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions.

3. Units shall utilize an insulated gate bipolar transistor (IGBT) technology as the input rectifier unit. This system shall be designed and configured such that IEEE 519 harmonic emission limits are inherently met without the need for external mitigation devices such as line reactors or filters.

4. The overvoltage trip level shall be a minimum of 30% over nominal, and the under-voltage trip level shall be a minimum 35% under the nominal voltage.

5. Normal Duty / Variable Torque output voltage and current ratings shall match the adjustable frequency operating requirements of a standard AC induction, synchronous reluctance (SynRM) or permanent magnet (PM) motors in water and wastewater applications. The short-term normal duty overload current capacity shall be 110% of rated current for one (1) minute out of ten (10) minutes.

6. Heavy Duty / Constant Torque output voltage and current ratings shall match the adjustable frequency operating requirements a standard AC induction, synchronous reluctance (SynRM) or permanent magnet (PM) motors in water and wastewater applications. The short-term heavy duty overload current capacity shall be 150% of rated current for one (1) minute out of ten (10) minutes and peak overload capacity shall be 180% for two (2) seconds out of each minute with an instantaneous overcurrent trip at 350% or higher.

7. Output frequency shall be adjustable between 0Hz and 500Hz forward or reversing. Operation above motor nameplate shall require programming changes to prevent inadvertent high-speed operation.

8. The VFD shall be furnished in an Open Chassis (IP00), UL Type 1 (NEMA 1) or UL Type 12 (NEMA 12) listed enclosure rated as specified for operation at ambient temperatures between -15°C and 40°C at an altitude not exceeding 3300 feet, with relative humidity less than 95% and no condensation allowed.

9. The printed circuit boards (PCB) shall be conformal coated to protect from atmospheric contamination by Chemical gasses and Solid particles per IEC 60721-3-3; Chemical gasses Class 3C2 and Solid particles Class 3S2.

2.2 MOTOR CONTROL

A. The VFD shall be capable of controlling an induction motor, permanent magnet motor and synchronous reluctance motors as standard. Have a maximum allowed motor cable length 1000 feet (300 meters). The VFD shall commission an induction motor, permanent magnet motor and synchronous reluctance motor with the motor nameplate values only, without the need to get the motor values from other sources.

B. Scalar and vector control modes shall be supported and there shall be independent control chains and parameters for both of the motor control modes.

C. The overload rating of the VFD shall be 110 % of its rated normal duty current for 1 minute every 10 minutes and with a minimum of 130 % for 2 seconds every 1 minute. Overload ability shall be available at all times - not only at start.

D. The VFD shall be capable of sensing the loss of load (broken belt / broken coupling / dry pump) and signal the loss of load condition. The drive shall be possible to be programmed to signal this condition via a control panel warning, relay output and/or over the serial communications.

E. Relay outputs shall include programmable for on/off time delays that will allow for drive acceleration or deceleration to and from zero speed, without signaling a false underload condition.

F. It shall be possible to disconnect a motor running full speed by opening an optional contactor between motor and VFD without causing any damage to the VFD.

G. The VFD shall include a standard embedded functional safety feature Safe Torque Off, (STO), to make the motor mechanically safe.

H. The VFD shall include an energy optimization circuit (flux optimization) that will automatically reduce applied motor voltage to the motor to reduce energy consumption by up to 10% and lower audible motor noise.

I. The VFD shall be capable of starting into a spinning load (forward or reverse) up to full speed and accelerate or decelerate to a set-point (flying start) without tripping or component damage.

J. The VFD shall restart after a power loss without the need to resend the start command. This feature shall be there regardless of the control source, control panel, I/O or fieldbus.

K. Flux braking shall be available, where the VFD controls the motor to dissipate the extra rotary energy as heat whenever braking is required. It shall be possible to use this flux braking feature to decelerate the motor from one speed to another – not only for stopping the motor.

L. Power-Loss-Ride-Through shall be programmable. If the incoming supply voltage is cut off, the VFD continues to operate using the kinetic energy of the rotating motor. The drive continues to be operational as long as the motor rotates and generates energy.

M. The VFD shall include a switching frequency control function. This adjusts the switching or carrier frequency, based on actual VFD temperature and allows the highest carrier frequency without de-rating the VFD or operating at high carrier frequency only at low speeds (temperature fold-back). It shall be possible to set a minimum and a reference switching frequency.

N. The VFD shall include a noise smoothing function, which distributes the acoustic motor noise over a range of frequencies instead of a single tonal frequency resulting in lower peak noise intensity.

O. The VFD shall have three (3) programmable critical frequency or critical speed lockout ranges to prevent the VFD from operating the load continuously on an undesirable speed range (skip frequencies)

2.3 STANDARD CONTROL HARDWARE FEATURES - ADJUSTABLE BY THE USER

A. General I/O

1. All I/O terminals shall be color coded to simplify wiring and troubleshooting and shall have a special mode for testing I/O and the drive configuration without being connected to equipment.

2. All I/O shall be accessible (monitor and control) for fieldbus protocols (pass-through I/O).

3. It shall be possible to monitor status of the I/O from VFDs control panel

B. ANALOG I/O

1. The VFD shall have at least two (2) programmable analog inputs. Both inputs shall accept current (0 to 20 mA or 4 to 20mA) or voltage (0 to 10 VDC) signals. The signal type selection, voltage or current, shall be made via VFD user interface. DIP-switches or jumpers are not allowed for input type programming. Analog Input shall have an inaccuracy of ≤1 % of full scale in both current and voltage modes

2. The analog inputs shall be programmable to be used as: speed reference, frequency reference, pressure monitor, PID loop controller's set-point reference or signal feedback, or other defined inputs.

3. If the analog input reference (4 to 20 mA or 2 to10 VDC) is lost, the VFD shall give the user the option of: (1) stopping and displaying a fault; (2) running at a programmable preset speed and displaying an alarm; (3) hold the VFD speed based on the last good reference received and displaying an alarm. The drive shall be programmable to signal this condition via a control panel warning, relay output and/or over the serial communication bus.

4. The VFD shall have at least two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA) out of which one shall be software configurable to be either voltage (0 to 10 VDC) or current output. Analog Output shall have an inaccuracy of ≤1 % of full scale in both current and voltage modes

5. The analog outputs shall be programmable to give an output signal proportional to frequency, motor speed, output voltage, output current, motor torque, motor power, DC bus voltage, active reference or other defined data.

C. DIGITAL I/O

1. The VFD shall have at least six (6) programmable digital inputs (24 VAC and 12 to 24 VDC, PNP or 5 pcs NPN) to connect to external devices, as follows:

   a. All inputs can be configurable for PTC sensors.

   b. There shall be a programmable run permissive circuit.

   c. Up to four (4) programmable free text interlock inputs shall be available.

   d. The VFD shall have at least one digital input which can be configured to receive a pulse signal up to 16 kHz.

D. Relay I/O

1. The VFD shall have at least three (3) programmable digital Form-C relay (changeover) outputs. The relays shall include programmable on and off delay times and adjustable hysteresis.

E. I/O Optional Extension Modules

1. The following I/O option modules shall be available:

   a. Relay Extension module with two relay outputs and one digital output, with an external input 24 volt to maintain power and control of module.

   b. PTC input module for up to 6 PTC sensors with an external input 24 volt to maintain power and control of module, and is capable of triggering the STO circuitry of the VFD.

   c. Digital input option module to provide additional 6 digital inputs which can be operated with 115 VAC or 230 VAC voltage.

2.4 SOFTWARE FEATURES

A. Pump SPECIFIC features:

1. The VFD shall have 2 quick ramps that allow for quick acceleration and/or deceleration of the pump motor.

2. The VFD shall offer a pump cleaning feature to reduce build-up of debris on the pump impeller. This feature can be activated by: Every start or Stop, when drive is

in a underload / overload condition, timed interval or digital input. The cleaning cycle status shall be visible in the panel screen when cleaning is active. The VFD shall operate normally after the cleaning cycle is completed.

3. The VFD shall offer torque boost for applications where increased torque is needed for initial starting of the pump motor.

4. The VFD shall have intelligent pump control (IPC) with multi-pump functionality and an intelligent master/follower configuration for controlling up to 8 parallel pumps equipped with VFD's without additional modules. VFD shall have a parameter synchronization feature to program the PID, IPC and AI parameters in all parallel VFD's. The Functionality to start and stop the pumps based on capacity, operating time or efficiency of the pump to ensure each pump is operated regularly.

    a. The IPC shall control:

        1) Level Control

        2) Flow Control

        3) Pressure Control

        4) Pump Alternation

5. The VFD shall have the ability to calculate the flow either based on the measured pressure difference or sensor-less flow calculations based on the power curve of the pump

6. The VFD shall have soft pipe filling functionality, can be used to fill an empty pipe, by having programmable pipe fill time.

7. The VFD shall have a programmable Sleep functionality for PID control in pumping systems to stop the pump during low demand. "Sleep Boost" shall be available to reduce short cycling of the pump. The boost function will boost the pressure or water level before the pump shuts down to sleep.

B. PID CONTROL

1. PID controller shall be standard in the drive, allowing an analog input signals to be connected to the VFD for the closed loop control. The VFD shall have 250 mA of 24 VDC power to power an external transmitter supplied by others. The loop controller set-point shall be adjustable from the VFD control panel, analog inputs, or over field bus. The set-point shall be set and displayed in engineering units.

2. There shall be two parameter sets for the first PID loop controller. Switching between the sets shall be possible via digital inputs, timed function, and serial communications or from the control panel.

3. The VFD shall have the ability to calculate water or air flow from pressure difference, from a differential pressure transducer or two separate pressure transducers.

C. FUNCTION BLOCK PROGRAMMING

1. The VFD shall provide a PLC kind programming capability as standard.

2. It shall be possible to use different kinds of arithmetic, logical, selection, comparison and operation function blocks to monitor and control the VFD, functions, inputs, outputs and variables.

3. There shall be a possibility to run different kinds of function block programs in different states and to set the criteria, when to change the state.

D. TIMED FUNCTIONS

1. Real-time clock and calendar shall be available as standard for giving true time and date information to fault event history. The real-time clock should have a minimum of 10 years power-off back-up without optional components. Back-up battery shall be replaceable without opening the VFD enclosure

2. Real time clock shall be possible to use with timed functions, which shall allow controlling the VFD and its functions based on time of the day, day of the week, seasons of the year, holiday periods and holiday dates and special working periods and working days

3. Timed functions should be possible to use for starting and stopping the drive, for selecting the speed reference, for selecting the PID loop controller's set-point, for controlling the relay outputs, for selection the control location, for giving the run permissive or interlock signal to the VFD, etc.

4. There shall be also a boost function, which allows starting the VFD and/or its functions regardless, time of the day, day of the week, seasons or holidays.

E. Fault Logger: A fault logger shall accommodate seven diagnostic values together with a date and time stamp.

F. Built in Energy Calculators: There shall be built-in counters for calculating energy savings achieved with the VFD.

1. Used and saved energy

2. CO_2 reduction

3. Saved money

4. Programmable kW Rate

G. Pre-Set Speeds: There shall be seven (7) programmable pre-set speeds.

H. Operating Values: All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. Engineering units shall be freely configurable for the user to display.

1. Output frequency

2. Motor speed (RPM, %, or engineering units)

3. Motor current

4. Calculated motor torque

5. Calculated motor power (kW)

6. DC bus voltage

7. Output voltage

8. Energy Consumption

I. Underload and overload curves shall be user-definable.

J. Independently adjustable acceleration and deceleration ramps with 1 to 1800 seconds adjustable time ramps. There shall be a possibility to use start delay before acceleration to ensure that all start conditions have been fulfilled.

K. Changed parameters list shall be available in order to assist commissioning and troubleshooting.

L. The VFD shall include pass code protection against unauthorized parameter changes. The pass code and the protection level shall possible to be defined by the user.

M. The VFD shall have ability to use any internal parameter value as input for any other parameter

N. The VFD shall have the capability to fault or to show warning when triggered from external sources.

2.5 PROTECTIONS

A. The following protection functions shall be available:

1. Dry pump Protection: (Prevent the pump from running dry. Protects the pumps bearings and shaft seal from damage when there is no water in the pump)

2. Overvoltage and under-voltage controller

3. Ground Fault (Earth-leakage) supervision

4. Motor short-circuit protection

5. Output and input switch supervision

6. Overcurrent protection

7. Phase-loss detection (both motor & line)

8. Underload and overload supervision

9. Freely configurable supervisions for any parameter or signal to trigger an action.

10. Communication loss functionality to ensure uninterrupted operation. The drive shall change control location from PLC to other external location identified by user, e.g. drive's embedded PID/loop controller and change back when communication is recovered.

11. The VFD shall have pump protection functions for flow and pressure to avoid damages of the pump and for leakage detection.

    a. Inlet protection for avoid dry run, cavitation and blocked pipe

    b. Outlet protection for avoid high pressure and leakages

    c. Stall protection for avoid running locked pump

2.6 USER INTERFACES

A. DETACHABLE CONTROL PANEL

1. The control panel shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bump-less transfer" of speed reference when switching between "Auto" and "Hand" modes. There shall be a possibility to reset the VFD from the control panel.

2. The control panel shall include a backlit LCD. The display shall be in complete words, in a language selectable by the user, for programming and fault diagnostics (alphanumeric fault codes are not acceptable)

3. The control panel shall have a real-time clock with battery backup for adding time stamps to events and also timer functions utilizing real-time clock.

4. There shall be an editable home-view in the control panel to allow different customer specific configurations

5. A dedicated "Help" button shall be available on the control panel. The Help button shall provide context sensitive assistance for programming and troubleshooting.

6. The control panel shall provide interactive assistants (wizards) to help to commission and use the drive.

7. The control panel shall provide a clear, interactive, context sensitive menu based user interface to make it easy to adjust the settings of the drive.

8. The control panel shall provide an easy to use I/O menu, where the user can see the status and function of all the analog and digital inputs and outputs.

9. The control panel shall have a menu, which contains diagnostic data about the drive operation collected in one single location. The data shall include data about active faults, warnings and events. In addition the data shall contain a summary of VFD active control sources.

10. The user shall be able to take a screen capture snapshot of the display with the control panel and be able to download the screen capture for user's computer for further purposes.

11. The user shall be able to connect a PC tool with a USB cable to the control panel to be able to set up and control the VFD. It shall be possible to connect the USB cable without using any tools.

12. The VFD shall provide a possibility for wireless communication to allow working outside the arc flash boundary area and to allow connection to the VFD remotely when there is no easy or safe access to the VFD. Wi-Fi connection is not acceptable because of its cyber security limitations.

13. The VFD supplied with wireless communications shall have a local control panel with control buttons regardless of the wireless connection possibility.

14. The control panel shall contain a back-up information of the VFD settings. Back-up information shall be possible to be saved on the control panel both manually and automatically.

15. The control panel shall be detachable in all types of enclosures, without tools to allow easy commissioning and programming of multiple VFDs.

16. The control panel shall have the capability to copy VFD settings from a VFD to next VFD, regardless of the VFD power, voltage or enclosure rating.

17. The control panel shall have an editable contact info that shows up in case of a fault.

B. NETWORK COMMUNICATIONS

1. The VFD shall be provided with plug-in or inbuilt communications over Profinet.

a. The use of third party gateways or multiplexers is not acceptable and all communication modules shall fit inside the enclosure of the VFD.

b. Communication capabilities shall include, but not be limited to: run-stop control, speed set adjustment, proportional/integral/derivative (PID) control adjustments, loop controllers' set-point adjustment, current limit, acceleration/deceleration time adjustments and lock and unlock the keypad.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall be the responsibility of the installing contractor. The drive installation must be in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual.

B. Power wiring shall be completed by the contractor, to NEC code 430.122 and adhering to local electrical codes, wiring requirements based on the VFD input current. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.2 START-UP

A. A factory-authorized service technician shall perform start-up on each drive. "Start-up" shall not include installation or termination of either power or control wiring. Start-up costs shall include time and travel for the estimated number of visits required.

3.3 PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are trained on the VFD products offered shall be locally available at the installation locations.

B. Training shall include installation, programming and operation of the VFD, and serial communication configuration. Factory authorized start up and owner training to be provided locally upon request.

3.4 WARRANTY (SELECTION REQUIRED)

A. The VFD Product Warranty shall be 24 months from the date of manufacture. A 36-month warranty shall be available with authorized factory start up and drive registration. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.

End of Section

SECTION 26 32 13 - DIESEL-ENGINE GENERATORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Product Requirements.
6. Installation.
7. Testing.

1.2 SCOPE

A. This Section includes packaged engine-generator sets suitable for use in mission critical applications with sub-base diesel tank, sound and fuel transfer pump as specified and indicated. Engine generators will be used as the Standby power source for the system, but shall be capable of providing reliable power with no run-time limitations while the primary source of power is unavailable.

B. Ensure required control and status signals are present and align on a per point basis between the generator and the ATS.

1.3 REFERENCE STANDARDS

Reference	Title
NFPA 99	Standard For the Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702
NFPA 110	(Emergency and Standby Power Systems) requirements for Level 1 emergency power supply system
CSA C22.2 No14	Industrial Control Equipment
CSA 282	Emergency Electrical Power Supply for Buildings
EN61000-6	Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments
EN55011	Industrial, Scientific and Medical Equipment – Radio-Frequency Disturbance Characteristics – Limits And Methods of Measurment
FCC Part 15 Subpart B	Radio Frequency Devices – Unintentional Radiators
ISO8528	Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets
IEC61000	EMC Test Systems
UL508	Standard for Safety For Industrial Control Equipment
UL2200	Standard for Safety Stationary Engine Generator Assemblies
UL142	Aboveground Flammable Liquid Tanks

A. Comply with UL 2200.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing equipment of types and capacities similar to those indicated for this Project and with a service center maintained by engine generator set manufacturer capable of providing training, parts, and emergency maintenance and repairs at the Project site with 24 hours maximum response time.

C. Source Limitations: Obtain engine generator set and auxiliary components from a single manufacturer with responsibility for entire system.

D. Listing and Labeling: Provide system components of types and ratings for which listing or labeling service is established and components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

E. Comply with NFPA 70.

F. Comply with NFPA 99.

G. Comply with NFPA 704, Hazard Identification signage.

H. Engine Exhaust Emissions: Comply with applicable federal, state, and local government requirements.

1. Tier 4 emission limits.

I. The manufacturer shall warranty the above specified equipment for 5 years from equipment start-up and commissioning to be free from defects in design workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

C. Catalog cuts shall be edited to show only the items, model numbers, and information which apply

D. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.

2. Time-current characteristic curves for generator protective device.

3. Sound test data, based on a free field requirement as measured and not calculated

E. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Wiring Diagrams: Control interconnection, Customer connections.

F. Load Calculations

1. Provide manufacturers load calculations that demonstrate the generator has been properly sized for the application.

    a. Obtain load information from the one line diagram and or the load summary.

b. Develop step and load starting sequence that corresponds to the logical operation of the facility.

1) Step sequencing shall assume all hardwired and non-automated equipment starts on step one.

2) Subsequent steps shall begin with starting of largest motors first and then transition to smaller.

3) Step sequence to be confirmed by the owner and engineer.

G. Certifications:

1. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary emergency application.

2. Submit statement of compliance which states the proposed product(s) are seismically certified in compliance with local requirements signed and sealed by a qualified professional engineer.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that the fuel tank, engine-generator set, and components will withstand seismic forces defined in 01 41 20 and including the following:

1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control test reports.

1. Certified summary of prototype-unit test report. See requirements in Part 2 "Source Quality Control" Article Part A. Include statement indicating torsional compatibility of components.

2. Certified Test Report: Provide certified test report documenting factory test per the requirements of this specification, as well as certified factory test of generator set sensors per NFPA110 level 1.

3. List of factory tests to be performed on units to be shipped for this Project.

4. Report of exhaust emissions and compliance statement certifying compliance with applicable regulations.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: -40.0 deg C to 70.0 deg C.

2. Relative Humidity: 0 to 95 percent, non-condensing, 30°C to 60°C.

3. Altitude: Sea level to 1000.0 feet (110.0 m).

4. IP22 protection for rear of controller; IP55 when installed in control panel.

5. 5% salt spray, 48 hours, +38°C, 36.8V system voltage.

6. Sinusoidal vibration 4.3G's RMS, 24-1000Hz.

7. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)

8. Shock: withstand 15G.

1.8 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: The basis for this specification is Caterpillar equipment, equal units may be considered if equipment performance is shown to meet the requirements herein.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.

C. Capacities and Characteristics:

1. Power Output Ratings: Electrical output power rating for Standby operation of not less than 30 kW, at 0.8 power factor, 240/120, Series Delta, Three phase, 3-wire, 60 hertz.

2. Provide locked rotor motor starting capability of 42 skVA at 30% instantaneous voltage dip as defined per NEMA MG 1. Sustained voltage dip data is not acceptable.

3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of components. The engine-generator nameplate shall include information of the power output rating of the equipment.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 0.5 percent of rated output voltage from no load to full load.

2. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 3 seconds. On application of a 100% load step the generator set shall recover to stable voltage within 10 seconds.

3. Steady-State Frequency Operational Bandwidth: 0.25 percent of rated frequency from no load to full load.

4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: not more than 3 percent variations for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 3 seconds. On application of a 100% load step the generator set shall recover to stable frequency within 10 seconds.

6. Output Waveform: At full load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.

8. Start Time: Comply with NFPA 110, Level 1, Type 10, system requirements.

9. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.

10. Load Sharing: Engine generator shall share real and reactive load proportionally within plus or minus 3 percent with all other engine generators in the system.

2.3 ENGINE

A. Fuel: ASTM D975 #2 Diesel Fuel

B. Rated Engine Speed: 1800RPM.

C. Four (4) Cycle

D. The engine will be equipped with an isochronous electronic governor to maintain +/- 6 RPM steady state frequency variation from steady state no load to steady state full load.

E. Lubrication System: The following items are mounted on engine or skid:

1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.

2. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.

3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

F. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions

G. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.

H. Cooling System

1. The generator set shall be equipped with a shell and tube heat exchanger and all accessories. The cooling system shall be sized to operate at full load conditions. The shell & tube heat exchanger shall consist of a steel shell welded to steel ring flanges, copper tubes brazed to brass tube sheets, brass baffles and cast iron or fabricated steel bonnets. The shell side of the heat exchanger shall be suitable to operate at a maximum pressure of 250 PSIG and at a maximum operating temperature of 350F. The tube side of the heat exchanger shall be suitable to operate at a maximum pressure of 150 PSIG and at a maximum operating temperature of 350F.

2. The heat exchanger cooling system shall be comprised of two circuits, a charged air circuit and jacket water circuit, in series. The jacket water circuit will be downstream of the charged air circuit and both will be cooled using city water.

I. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.

1. Designed for operation on a single 120 VAC, Single phase, 60Hz power connection. Heater voltage shall be shown on the project drawings.

2. Installed with isolation valves to isolate the heater for replacement of the element without draining the engine cooling system or significant coolant loss.

3. Provided with a 24VDC thermostat, installed at the engine thermostat housing

J. Governor: Adjustable isochronous, with speed sensing. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate as appropriate to the state of the engine generator. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous states.

K. Cooling System

1. The generator set shall be equipped with a shell and tube heat exchanger and all accessories. The cooling system shall be sized to operate at full load conditions. The shell & tube heat exchanger shall consist of a steel shell welded to steel ring flanges, copper tubes brazed to brass tube sheets, brass baffles and cast iron or fabricated steel bonnets. The shell side of the heat exchanger shall be suitable to operate at a maximum pressure of 250 PSIG and at a maximum operating temperature of 350F. The tube side of the heat exchanger shall be suitable to operate at a maximum pressure of 150 PSIG and at a maximum operating temperature of 350F. The completed assembly shall be painted black.

2. The heat exchanger cooling system shall be comprised of two circuits, a charged air circuit and jacket water circuit, in series. The jacket water circuit will be downstream of the charged air circuit and both will be cooled using city water.

L. Muffler/Silencer: A critical grade silencer, companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. Mounting shall be provided by the contractor as shown on the drawings. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer.

M. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.

N. Starting System: 24VDC with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.

2. Cranking Cycle: As required by NFPA 110 for level 1 systems.

3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.

4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.

5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.

6. Battery Chargers: Unit shall comply with UL 1236, provide fully regulated, constant voltage, current limited, battery charger for each battery bank. It will include the following features:

    a. Operation: Equalizing-charging rate based on generator set manufacturer's recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 20 deg C to plus 40 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.

    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.

    d. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

    e. Provide LED indication of general charger condition, including charging, faults, and modes. Provide a LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA110.

    f. Enclosure and Mounting: NEMA, Type 1, wall-mounted cabinet.

2.4 FUEL STORAGE

A. Comply with NFPA 30.

B. Sub Base-Mounted Fuel Tank: Provide a double wall secondary containment type sub base fuel storage tank. The tank shall be constructed of corrosion resistant steel and shall be UL 2085 listed and labeled in non-secure areas and UL-142 rated in areas where vandalism and physical damage are not likely. The fuel tank shall include the following features:

    1. Capacity shall be sized for 24 Hour(s) continuous operation at 100 percent rated power output.

    2. Tank rails and lifting eyes shall be rated for the full dry weight of the tank and genset.

    3. Electrical stub up(s)

    4. Normal & emergency vents

5. Lockable fuel fill

6. Mechanical fuel level gauge

7. High and low level switches to indicate fuel level

8. Leak detector switch

9. Sub base tank shall include a welded steel containment basin, sized at a minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a tank rupture.

10. Double wall sub-base tank constructed to meet all local codes and requirements. A fuel tank base of with capacities shown below shall be provided as an integral part of the enclosure. It shall be contained in a rupture basin with 110% capacity. The tank shall meet UL142 standards.

    a. South Welches – 24 hours capacity
    b. Sieben Lane – 24 hours capacity
    c. 82nd Drive – 24 hours capacity
    d. Golf Club Terrace – 48 hours capacity

11. A five gallon spill containment and overfill prevention valve with 90% and 95% alarms, a mechanical reading fuel level gauge, low fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.

12. Fill port with overfill prevention valve (OFPV)

13. Tank design shall meet the regional requirements for the Project location

2.5 CONTROL AND MONITORING

A. Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939.

B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

D. Configuration: Operating and safety indications, protective devices, system controls, engine gages and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.

E. The control shall include Modbus RTU communications as standard via RS-485 half duplex with configurable baud rates from 2.4k to 57.6k.

F. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter (3-phase, line to line and line to neutral values).
2. AC ammeter (3-phases).
3. AC frequency meter.
4. AC kW output (total and for each phase). Display shall indicate power flow direction.
5. AC kVA output (total and for each phase). Display shall indicate power flow direction.
6. AC Power factor (total and for each phase). Display shall indicate leading or lagging condition.
7. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
8. Emergency Stop Switch: Switch shall be a red "mushroom head" pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.
9. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
10. DC voltmeter (alternator battery charging).
11. Engine-coolant temperature gauge.
12. Engine lubricating-oil pressure gauge.
13. Running-time meter.
14. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control adjustment of these parameters shall be in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.)
15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel supply alarm.

17. AC Protective Equipment: The control system shall include over/under voltage, reverse kVAR, reverse kW, over load (kW) short circuit, over current, loss of voltage reference, and over excitation shut down protection. There shall be a ground fault alarm for generator sets rated over 1000 amps, overload warning, and overcurrent warning alarm.

18. Status LED indicating lamps to indicate remote start signal present at the control, existing shutdown condition, existing alarm condition, not in auto, and generator set running.

19. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.

20. Panel lighting system to allow viewing and operation of the control when the generator room or enclosure is not lighted.

21. Data Logging: The control system shall log the latest 20 different alarm and shut down conditions, the total number of times each alarm or shutdown has occurred, and the date and time the latest of these shutdown and fault conditions occurred.

22. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage recover on loading (engine cranking).

G. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

1. Low oil pressure alarm/shutdown.
2. High coolant temperature alarm/shutdown.
3. Loss of coolant shutdown.
4. Overspeed shutdown.
5. Overcrank shutdown.
6. Low coolant level alarm.
7. Low fuel level alarm.
8. Emergency stop depressed shutdown.
9. Low coolant temperature alarm.
10. Low battery voltage alarm.
11. High battery voltage alarm.
12. Control switch not in auto position alarm.
13. Battery charger failure alarm.

H. Generator Alarm/Shutdown

1. Generator Over Voltage.
2. Generator Under Voltage.
3. Generator Over Frequency.
4. Generator Under Frequency.
5. Generator Overcurrent.

I. The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units.

1. Engine:

a. Engine oil pressure
b. Engine oil temperature
c. Engine coolant temperature
d. Engine RPM
e. Battery volts

2. Generator:

a. Generator AC volts (Line to Line, Line to Neutral and Average)
b. Generator AC current (Avg and Per Phase)
c. Generator AC Frequency
d. Generator kW (Total and Per Phase)
e. Generator kVA (Total and Per Phase)
f. Generator kVAR (Total and Per Phase)
g. Power Factor (Avg and Per Phase)
h. Total kW-hr
i. Total kVAR-hr
j. % kW
k. % kVA
l. % kVAR

2.6 CIRCUIT BREAKER

A. Provide a generator mounted 80% circuit breaker, molded case, size as shown on the contract drawings, 3 pole, and NEMA 1/IP22. Breaker shall utilize a solid state LSI trip unit. The breaker shall be UL/CSA Listed and connected to engine/generator safety shutdowns. Breaker shall be housed in an extension terminal box which is isolated from vibrations induced by the generator set. Mechanical type lugs, sized for the circuit breaker feeders shown on drawing, shall be supplied on the load side of breaker.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H

D. Temperature Rise: 125 / Class H environment.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.

G. Enclosure: Drip-proof.

H. Voltage Regulator: The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load. The regulator shall be a totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, over-excitation protection, shall limit voltage overshoot on startup, and shall be environmentally sealed.

I. Windings: The excitation system shall be of brushless construction and be independent of main stator windings (either permanent magnet or auxiliary windings).

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Sound Attenuated Steel housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.

B. Construction:

1. Louvers: Equipped with bird screen to permit air circulation when engine is not running while excluding birds and rodents.

2. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.

3. Exhaust System:

a. Muffler Location: Within enclosure.

4. Hardware: All hardware and hinges shall be stainless steel.

5. Mounting Base: Suitable for mounting on sub-base fuel tank or housekeeping pad.

6. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.

7. Inlet ducts shall include rain hoods

C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40 deg C.

1. Louvers: Fixed-engine, cooling-air inlet and discharge.

D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 68 dBA measured at any location 7 m from the engine generator in a free field environment.

E. Site Provisions:

1. Lifting: Complete assembly of engine generator, enclosure, and sub base fuel tank shall be designed to be lifted into place as a single unit, using spreader bars.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with NFPA 110.

B. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

C. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

D. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

E. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.

F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

G. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer's recommended practice.

3.2 CLEANING

A. Upon completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.3 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable switches and circuit-breaker trip ranges.

3.4 OPERATION AND MAINTENANCE MANUALS

A. Provide two (2) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

3.5 ON-SITE ACCEPTANCE TEST

A. Verify that the equipment is installed properly.

B. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, remote annunciator, etc.

C. Test all alarms and safety shutdown devices for proper operation and annunciation.

D. Check all fluid levels.

E. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.

F. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.

G. Connect the generator to building load and verify that the generator will start and run all designated loads.

H. The system shall be tested under full load and monitor the following readings:

1. Oil pressure
2. Coolant temperature
3. Battery charge rate
4. AC volts
5. AC Amperes- all phases
6. Frequency
7. Kilowatts
8. Ambient Temperature

3.6 TRAINING

A. Provide on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

3.7 FIELD QUALITY CONTROL

A. The dealer shall maintain qualified factory trained service personnel.

3.8 SERVICE AGREEMENT

A. The engine-generator supplier shall maintain 24-hour parts and service capability within 100 miles of the project site. The distributor shall stock parts as needed to support the generator set package for this specific project. The supplier must carry sufficient inventory to cover no less than 80% parts service within 24hrs and 95% within 48 hours.

END OF SECTION

SECTION 26 36 14

3-WAY MANUAL TRANSFER SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. System Requirements
3. Quality Assurance.
4. Submittals.
5. Products
6. Installation
7. Testing

1.2 SCOPE

A. The Contractor shall furnish, install and test the 3-way Manual Transfer Switch (MTS) with the amperage, voltage, and withstand current ratings as shown on the drawings and specified herein.

B. Coordinate with the Generator Supplier to ensure proper interconnection of the generator and MTS and generator and ATS that proper operation of the generator will be assured.

1.3 SYSTEM REQUIREMENTS

A. The 3-way MTS shall be rated for use at 240VAC or 480 VAC, 3-phase as shown on the plans with a withstand rating of 35,000 AIC unless otherwise shown on the drawings.

1.4 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.

a. UL 1008 - Standard for Manual Transfer Switches

B. The 3-way MTS manufacturer shall provide a complete factory assembled, wired and tested 3-way manual transfer switch.

C. 3-way manual transfer switch shall be factory Hi-pot tested for a period of not less than 60 seconds.

D. 3-way manual transfer switch installation shall meet all applicable NEC standards.

1. 2017 NEC 700.3(F) compliant when used in conjunction with and ATS and appropriate auxiliary equipment.

E. The manufacturer shall warranty the above specified equipment for a minimum period of (1) one year after shipment from manufacturer.

1.5 SUBMITTALS

A. REQUIREMENTS: Section 01 33 00.

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

   b. Catalog cuts shall be edited to show only the items, model numbers, and information which are applicable and crossing out all inapplicable information.

   c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

4. Installation instructions, outline dimensions and weights, front view drawing identifying control and monitoring devices, nameplate engravings, shipping dimensions, weight, and wall mounting requirements.

5. Component List

6. Conduit entry/exit locations where applicable

7. Assembly ratings including:

   a. Short-circuit rating

   b. Voltage

   c. Continuous current

8. Cable terminal sizes

9. Product data sheets, external connection diagram showing function and identification of all terminals requiring field connections.

10. O&M Manuals per Section 01 33 00 and Section 26 05 00.

11. Schematics and wiring diagrams.

12. Recommended spare parts list.

13. Factory test documentation.

14. In accordance with seismic anchoring requirements:

    a. Certification of compliance with local code and seismic designation.

    b. A sketch or description of the anchorage and restraint system.

PART 2 PRODUCTS

2.1 MANUFACTURES

A. 3-way Manual Transfer Switch candidate manufactures and models:

1. ESL – Tripleswitch Series

2. Foxfab – FFCC Series.

2.2 3-WAY MANUAL TRANSFER SWITCH

A. Furnish and install where indicated a 3-way Manual transfer switch with ratings, features, accessories, enclosures, etc. indicated on the drawings or noted herein.

B. The transfer switch equipment as specified herein shall be rated for continuous duty at the ratings shown on the plans and shall conform to the applicable requirements for UL 1008 for emergency total system load. All transfer switch equipment supplied shall bear the UL label.

C. 3-way MTS shall consist of (2) mechanically-interlocked molded case circuit breakers, and (1) independent load bank breaker, male cam-style inlet connectors, female cam-style outlet connectors, power distribution blocks and grounding terminals, all housed within a padlockable enclosure.

D. 3-way MTS enclosure shall be Type 3R, constructed of continuous seam-welded, powder coated galvanneal steel. The main access shall be through an interlocked, hinged door that extends the full height of the enclosure. Access for both portable generator cables with female cam-style plugs and for load bank cables with male cam-style plugs shall be via a drawn flange cable entry openings in the bottom of enclosure. A hinged flap door shall be provided to cover the cable openings when cables are not connected; the hinged flap door shall allow cable entry only after the main access door has been opened. Enclosure shall be powder coated after fabrication; color shall be wrinkle gray RAL 7035.

E. Cam-style male connectors (inlets) and cam-style female connectors (outlets) shall be UL Listed single-pole separable type and rated 400 amps at 600VAC. All cam-style connectors shall be color coded. Cam-style connectors shall be provided for each phase and for ground, and shall also be provided for neutral. Each of the phase cam-

style connectors and the neutral cam-style connectors within the enclosure shall be factory-wired to a molded case circuit breaker. The ground cam-style male connectors shall be bonded to the enclosure, and a ground lug shall be provided for connection of the facility ground conductor. None of the cam-style connectors shall be accessible unless all (3) molded case circuit breakers are in the "OFF" position and the main access door is open.

F. A power distribution block shall be provided for load-side field wiring. The power distribution block shall be factory wired to the molded case circuit breakers.

G. Molded case circuit breakers shall be UL Listed 3-pole and the short circuit interrupt rating shall be a minimum of 35kAIC at 480VAC or 240VAC as required. Trip rating of the molded case circuit breakers shall be as shown on the drawings. One molded case circuit breaker shall control the connection between the permanent generator and the automatic transfer switch. A second circuit breaker shall control the connection between the permanent generator and the load bank female cam-style connectors. A third circuit breaker shall control the connection between the portable generator (via male cam-style connectors) and the automatic transfer switch. All (3) molded case circuit breakers shall include UL Listed door-mounted operating mechanisms, preventing the opening of the main access door unless all (3) breakers are in the "OFF" position. All (3) molded case circuit breakers shall be mounted behind a deadfront panel. The load-side of the molded case circuit breakers shall not be energizable unless the main access door is closed and one of the molded case circuit breakers is in the "ON" position. The (2) molded case circuit breakers controlling the connections between the permanent generator and the automatic transfer switch, and the connection between the portable generator and automatic transfer switch shall be safety interlocked by mechanical means to ensure that only one of these breakers can be closed at any given time.

H. An auxiliary contact shall be provided in the circuit breaker controlling the connection from the Permanent Generator to the ATS and shall be factory wired to terminal blocks within the enclosure. The auxiliary contact is provided in compliance with NEC 2017 700.3 (F)(5) which requires a means to activate an annunciator circuit.

I. The following features/accessories shall be provided:

1. Pilot lights to indicate to which position the MTS is in.

    a. MTS in "Normal" position
    b. MTS in "Test" position
    c. MTS in "Emergency" position

PART 3 PART 3 EXECUTION

3.1 INSTALLATION

A. Install as shown on the drawings and per the manufacturer's written instructions. Coordinate interconnection with the generator supplier.

B. Conduit entry into the 3-way manual transfer switch shall be by Contractor; Contractor shall furnish and install listed watertight conduit hubs, as manufactured by MYERS or T&B, for each conduit entry on the 3-way manual transfer switch. The incoming hub size shall match the conduit size for feeders and ground as shown on the drawings. The outgoing hub size shall match the conduit size for loads and ground as shown on the drawings. Hubs shall be properly installed and tightened to maintain Type 3R integrity of the 3-way manual transfer switch enclosure.

1. All conduit entries into equipment located in damp or wet locations shall be through the bottom or lower sides of enclosures. Top entry of conduits will not be allowed.

C. Contractor shall terminate feeder conductors, load conductors and ground per the manufacturer's instructions. All field wiring terminations shall be torqued as required per the instructions on the 3-way manual transfer switch's power distribution blocks, circuit breakers & ground lugs.

3.2 TESTING

A. Service Equipment shall be tested for proper operation and function in accordance with Section 26 08 00.

B. Field Test the unit per the manufacturer's recommendations and confirm operation by following the directions on the main access door.

C. Verify that when load testing the generator, should utility power fail, the MTS will transfer power from the load bank to the plant via the ATS.

D. The complete MTS shall be factory tested to ensure proper operation of the individual components.

E. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

END OF SECTION

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. System Requirements
3. Quality Assurance
4. Submittals
5. Products
6. Installation
7. Testing

1.2 SCOPE

A. The Contractor shall furnish and install Automatic Transfer Switch (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the drawings. Each automation transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller, interconnected to provide complete automatic operation.

B. Coordinate with the Generator Supplier to ensure proper interconnection of the generator and ATS and generator and that proper operation of the generator will be assured.

1.3 SYSTEM REQUIREMENTS

A. The ATS shall be Rated for use at 480 VAC, 400 amps with a withstand rating of 65,000 AIC unless otherwise shown on the drawings. Unit shall be 3-pole with a solid neutral unless shown or specified differently on the drawing.

1.4 REFERENCE STANDARDS

A. 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.

B. 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.

1. UL 1008: Underwriters Laboratories standard for automatic transfer switches.
2. CSA: C22.2 No. 178 certified at 600 VAC.
3. IEC: 947-6-1 certified at 480 VAC.
4. NFPA 70: National Electrical Code including use in emergency and standby systems in accordance with Articles 517, 700, 701, 702.
5. NFPA 99: Essential electrical systems for health care facilities
6. NFPA 101: Life safety code
7. NFPA 110: Standard for emergency and standby power systems
8. IEEE 241: I.E.E.E. recommended practice for electrical power systems in commercial buildings
9. IEEE 446: I.E.E.E. recommended practice for emergency and standby power systems
10. NEMA ICS10: AC automatic transfer switch equipment (supersedes ICS2-447)
11. UL 50/508: Enclosures
12. ICS 6: Enclosures
13. ANSI C33.76: Enclosures
14. NEMA 250: Enclosures
15. IEEE 472: (ANSI C37.90A): Ringing wave immunity
16. EN55022 (CISPR11): Conducted and radiated emissions (Exceeds EN55011 & MILSTD 461 Class 3)
17. EN61000-4-2: (Level 4): ESD immunity test Class B:
18. EN61000-4-3: (ENV50140): Radiated RF, electromagnetic field immunity test
19. EN61000-4-4: Electrical fast transient/burst immunity test

20. EN61000-4-5: IEEE C62.41: Surge immunity test (1.2 x 50µs, 5 & 8 kV)

21. EN61000-4-6: (ENV50141): Conducted immunity test

22. EN61000-4-11: Voltage dips and interruption immunity

23. IEE-693-2005: Seismic certified at high level with 2.5 amplification factor

24. IBC-2003: At Ip=1.5 for z/h less than or equal to 1 (in accordance with ICC-ES-AC156)

1.5 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

4. Catalog cuts shall be edited to show only the items, model numbers, and information which apply

5. Installation instructions, outline dimensions and weights, front view drawing identifying control and monitoring devices, nameplate engravings, shipping dimensions, weight, and wall mounting requirements.

6. Certification from the project generator supplier that the ATS provides all the features and functions required to monitor and control their generator adequately.

7. Component list

8. Conduit entry/exit locations where applicable

9. Assembly ratings including:

   a. Short-circuit rating

   b. Voltage

   c. Continuous current

10. Cable terminal sizes

11. Product data sheets, external connection diagram showing function and identification of all terminals requiring field connections.

12. O&M manuals per Section 01 33 00 and Section 26 05 00.

13. Schematics and wiring diagrams.

14. Recommended spare parts list.

15. Factory test documentation.

16. In accordance with seismic anchoring requirements:

a. Certification of compliance with local code and seismic designation.

b. A sketch or description of the anchorage and restraint system.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

PART 2 PRODUCTS

2.1 CANDIDATE MANUFACTURES/PRODUCTS

A. Candidate manufacturers and models are listed below. To conform to specified requirements, the manufacturer's standard product may require modification.

1. Caterpillar Model CG Series

2. Approved Equal

2.2 AUTOMATIC TRANSFER SWITCH

A. Furnish and install where indicated a "programmed (delayed) transition" style, 3-pole (with solid neutral) automatic transfer switch with ratings, features, accessories, enclosures, etc. indicated on the drawings or noted herein.

B. The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.

C. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.

D. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.

E. The transfer switch equipment as specified herein shall be 100% equipment rated for continuous duty at the ratings shown on the plans and shall conform to the applicable

requirements for UL 1008 for emergency total system load. All transfer switch equipment supplied shall bear the UL label.

F. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.

G. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.

H. Switches composed of molded case breakers, lighting contactors or components thereof will not be acceptable.

I. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.

J. The automatic transfer switch must be equipped with a solenoid production scheme that removes any attempts of operating the solenoids after (3) consecutive trials until manual intervention by an operator.

K. All main power contacts shall be rated for multiple fault interruptions per UL 489, and/or UL 1087. Main contacts shall have independent “break-before-make” transfer action which shall positively prevent dangerous “source-to-source” connections.

L. Automatic transfer switches specified herein shall consist of completely enclosed contact assemblies and a separately mounted control logic panel. Control power for all automatic transfer operations shall be derived from the line side of the source to which the load is being transferred.

M. Upon loss of phase-to-phase voltage of the normal power source on any phase to 70% of nominal, and after a time delay of 0-60 seconds (adjustable to meet conditions present) to override momentary dips and/or outages, starting of the emergency/standby power source shall be initiated. Transfer to the emergency standby power source shall take place 0-60 minutes (adjustable) after attainment of 90% of rated voltage and frequency of that source.

N. When the normal power source has been restored to 90% of rated voltage and after a time delay adjustable from 0-120 minutes (to insure the integrity of the normal power source), the load shall be retransferred to the normal source.

O. A time delay, adjustable 0-60 minutes, shall delay shutdown of the emergency/standby power source after retransfer to allow the generator to run unloaded for cool-down, after which the generator shall be automatically shut down.

P. If the emergency/standby power source should fail while carrying the load, transfer to the normal power source shall be made instantaneously upon restoration of the normal source to satisfactory conditions.

Q. The following features/accessories shall be provided:

1. Auto/test switch to provide test operation of the automatic transfer switch by simulating a loss of the normal power source.

2. LED indicators to indicate to which source the load is connected.

3. LCD display to indicate that an integral overcurrent protective device has tripped.

4. Plant exerciser Adjustable time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds factory set at 3 seconds providing automatic test operation of the emergency/standby power source at pre-selected intervals at least once per week, including a selector switch to select exercise with or without load or a bypass of the exercise period. The clock timer shall be provided with a digital readout and include a lithium battery backup to assure continuity of power to the clock timer for a minimum of 72 hours during an outage.

5. Provide “dry”, form C contacts for the following conditions, as a minimum. Contacts shall be rated 10 Amps at 120 VAC:

a. ATS in “Normal” position
b. ATS in “Generator” position

R. If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.

2.3 ATS CONTROLS

A. The control panel shall be opto-isolated from electrical noise and provided with the following inherent control functions and capabilities:

1. Easy-to-view, backlit LCD display with long lasting LED indicators

2. Control panel shall display voltage and frequency of both sources

3. The user shall be able to view the last 16 recorded events

4. Capability for external communication and network interface

5. Adjustments to all settings shall be made from the front of the panel without opening the door.

B. The digital display shall be accessible without opening the enclosure door and shall be provided with a 4 line by 20 character LCD display screen with touch pad functions and display menus. The programming functions shall be pass code protected.

C. The control panel shall be provided with menu driven display screens for transfer switch monitoring, control and field changeable functions and settings.

D. All programmable and control functions shall be pass code protected and accessible through the keypad.

E. The control panel shall be provided with a simple user interface for transfer switch monitoring, control and field changeable functions and settings.

F. Touch pad test switch with Fast Test/Load/No Load selection capability to simulate a normal source failure.

G. The controller shall include a built-in synchroscope to display the phase angle differential and ensure disturbance-free transfer operation between sources.

H. The controller shall provide digital timer adjustments with 1-second resolution. Voltage and Frequency shall be adjustable to 1% resolution to facilitate accurate transfer.

I. To ensure reliable and consistent user operation the controls must be equipped with nonvolatile memory and allow automatic daylight savings time adjustment.

J. A single controller capable of all transfer modes, open/delayed/closed and bypass isolation shall be provided. Real time display of transfer status and active timers must be supplied.

K. In addition to the operational elements required to satisfy the sequence of operation and other functions specified herein, the following ATS features shall be provided:

1. Adjustable time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds factory set at 3 seconds.

2. Adjustable time delay on retransfer to normal source, programmable 0-60 minutes factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.

3. A time delay on transfer to emergency, programmable 0-5 minutes, factory set at 1 second.

4. An adjustable time delay shall be provided on transfer to either source to allow the ATS to dwell in a center-off position. This time delay must be adjustable through a range of 0 to 10 minutes and be factory set at 5 seconds.

5. An exerciser timer with momentary test pushbutton shall be incorporated within the microprocessor and shall be capable of starting the engine generator set and transferring the load (when selected) for exercise purposes on a daily, weekly or monthly basis. The exerciser shall contain a battery for memory retention during an outage.

6. Provide a momentary pushbutton to bypass the time delays on transfer and retransfer and programmable commit/no commit control logic.

7. A set of customer contacts shall be provided to indicate both emergency and normal source position.

8. An adjustable over/under frequency and voltage sensor for both emergency and normal sources.

9. Visual indication of switch position and source acceptability shall be provided for both emergency and normal sources.

10. An engine start contact with an adjustable cool down timer.

11. A three phase Voltage Imbalance Monitor shall detect an imbalance and initiate a transfer to the alternate source. Adjustable 5-20% of nominal with a time delay of 10-30 seconds for nuisance conditions.

2.4 ACCESSORIES

A. Test Switch (6A) – Maintained

B. Additional Auxiliary Contacts (A3) - Closed when the transfer switch is in Source 2 position.

C. Additional Auxiliary Contacts (A4) - Closed when the transfer switch is in Source 1 position.

D. Disconnect Switch (DS) - Inhibits transfer in either direction when in inhibit.

E. Inhibit transfer (Q7) – Provides additional relay to inhibit transfer to Normal.

F. Automatic or Manual Selector (S5) – Provide ability to manually transfer to Normal source.

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 26 05 00 and Install in accordance with manufacturer's instructions for the specified functional requirements.

B. Automatic Transfer Switches shall be installed, configured and tested on site in accordance with the requirements of Section 26 05 00 and in accordance with the manufacturer's recommendations. Field Setup shall be conducted by a technical representative, factory trained and certified by the manufacturer.

C. CONTRACTOR shall provide the services of the manufacturer's representative for a minimum of one day for the calibration and testing of the equipment after certification of proper installation.

D. Unless specified otherwise on the drawings, the switch shall be mounted in a NEMA 1 enclosure in Non-Damp and Wet locations.

3.2 TESTING

A. Service Equipment shall be tested for proper operation and function in accordance with Section 26 08 00.

B. Coordinate with Generator supplier to provide an integrated test to demonstrate ATS senses loss of utility power, starts the generator, verifies the electrical output from the generator is valid and transfer the load to the standby power source.

C. Verify also that restoring Utility power is sensed appropriately by the ATS and that after the selected time delay, restores utility power to the generator. Verify proper generator cool down run time is provided for either in the generator or in ATS settings.

D. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

E. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

B. The transfer switch manufacturer shall submit test data for each size switch, showing it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity. Each ATS shall be in strict accordance and listed to UL

1008 withstand standards, including “Any Breaker” ratings. Minimum UL listed withstand and close into fault ratings shall be as follows:

Size (Amps)	“Any Breaker” Rating	Current Limiting Fuse
40 to 150	10,000	200,000
225 to 400	35,000	200,000
600 to 1200	50,000	200,000
1600 to 4000	100,000	200,000

(All values at 480V RMS symmetrical, less than 20% power factor)

ATS’s which offer only ‘specific coordinated breaker’ ratings (as opposed to “any breaker” ratings) do not meet this specification and are not acceptable

F. A dielectric test at the conclusion of the withstand and closing tests shall be performed.

END OF SECTION

SECTION 26 51 19 - LED INTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Abbreviations
3. Reference Standards
4. Quality Assurance.
5. Submittals.
6. Product Requirements.
7. Installation.
8. Testing.

1.2 SCOPE

A. This Section includes the supply and installation of interior LED lighting fixtures and associated equipment.

1.3 ABBREVIATIONS

A. CCT: Correlated color temperature.
B. CRI: Color Rendering Index.
C. Fixture: See "Luminaire."
D. IP: International Protection or Ingress Protection Rating.
E. LED: Light-emitting diode.
F. Lumen: Measured output of lamp and luminaire, or both.
G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 REFERENCE STANDARDS

A. ASTM – American Society for Testing and Materials
B. ANSI C79.1, C81.61 – American National Standards Institute
C. NEMA LE 4 – National Electrical Manufacturer's Association
D. NFPA 70 – National Electrical Code (NEC)

1.5 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. SPECIAL WARRANTY: The Special Warranty shall include as a minimum the following:

1. A written 5-year on-site replacement material, fixture finish and workmanship. On-site replacement includes transportation, removal, and installation of new products. Finish warranty must include warranty against failure or substantial deterioration such as blistering, cracking, peeling, chalking or fading.

2. A written 5-year replacement material warranty for defective or non- starting LED source assemblies.

3. A written 5-year replacement material warranty on all power supply units (PSU).

4. A written 5-year replacement warranty for luminaires producing inadequately maintained illuminance levels at the end of the warranty period, as prorated from levels expected at end of useful life.

5. The warranty period shall begin on the date of Substantial Completion. The Contractor shall provide the Owner with appropriate signed warranty certificates. The Owner shall have received these certificates prior to final payment.

C. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

D. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

E. Provide luminaires from a single manufacturer for each luminaire type.

F. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

4. Catalog cuts shall be edited to show only the items, model numbers, and information which apply

   a. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

   b. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

   c. Arrange in order of luminaire designation.

   d. Include data on features, accessories, and finishes.

   e. Include physical description and dimensions of luminaires.

   f. Include emergency lighting units, including batteries and chargers.

   g. Include life, output (lumens, CCT, and CRI), and energy efficiency data.

5. Photometric data and adjustment factors based on laboratory tests.

   a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

   b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

C. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

D. Product Schedule: For luminaires and lamps.

E. Manufacturer's installation instructions.

F. CLOSEOUT SUBMITTALS

1. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

2. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

G. MAINTENANCE MATERIAL SUBMITTALS

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

2. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Recessed Fixtures: Comply with NEMA LE 4.

E. LED Drivers

1. Class 1, constant current.
2. Power factor >90% at full load.
3. THD <20%.
4. Integral surge protection in accordance with ANSI C62.41.2.
5. Minimum 5-year warranty.

F. LED Lamps

1. Color temperature range from 3500K – 5500K based on specific project parameters.
2. CRI >80.

3. Lumens per watt >80.
4. Minimum 70,000-hour life at above 70% rated light output.

G. Lamps dimmable from 100 percent to 1 percent of maximum light output.

H. Internal driver.

I. Nominal Operating Voltage: as specified on plans.

1. Lens Thickness: At least 0.125-inch (3.175 mm) minimum unless otherwise indicated.

J. Housings:

1. Refer to plans.

2.2 INTERIOR LUMINAIRE FIXTURE SCHEDULE

A. Refer to Fixture Schedule on the Drawings.

2.3 CYLINDER

A. Refer to plans for acceptable products.
B. With integral mounting provisions.

2.4 DOWNLIGHT

A. Refer to plans for acceptable products.
B. Universal mounting bracket.
C. Integral junction box with conduit fittings.

2.5 LINEAR INDUSTRIAL

A. Refer to plans for acceptable products.

2.6 RECESSED LINEAR

A. Refer to plans for acceptable products.
B. Integral junction box with conduit fittings.

2.7 STRIP LIGHT

A. Refer to plans for acceptable products.
B. Integral junction box with conduit fittings.

2.8 SURFACE MOUNT, LINEAR

A. Refer to plans for acceptable products.
B. Integral junction box with conduit fittings.

2.9 SURFACE MOUNT, NONLINEAR

A. Refer to plans for acceptable products.
B. Integral junction box with conduit fittings.

2.10 SUSPENDED, NONLINEAR

A. Refer to plans for acceptable products.
B. Integral junction box with conduit fittings.

2.11 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2. Glass: Annealed crystal glass unless otherwise indicated.

3. Lens Thickness: At least 0.125-inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. See plans for finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.12 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.13 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12-gage (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.

3. Provide support for luminaire without causing deflection of ceiling or wall.

4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.

2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.

3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120-inches (6m) in length.

2. Ceiling mount with pendant mount with 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.

3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.

2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.

3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.

4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.

2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 26 08 00 Commissioning of Electrical Systems.

3.7 CLEANING AND ADJUSTING

A. Clean units after installation. Use methods and materials recommended by manufacturer.

B. Adjust amiable luminaires and luminaires with adjustable lamp position to provide required light distributions and intensities.

END OF SECTION

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SECTION 26 56 19 - LED EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Abbreviations
3. Reference Standards
4. Quality Assurance.
5. Submittals.
6. Product Requirements.
7. Installation.
8. Testing.

1.2 SCOPE

A. The extent and location of “Exterior Lighting” Work is shown in the Contract Documents. This section includes exterior luminaires and accessories.

B. Definitions:

1. Luminaire (Light Fixture): A complete lighting device consisting of LED’s and driver’s, when applicable, together with parts designed to distribute light and to connect to power supply.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code
B. NFPA 70E – National Electrical Safety Code
C. NFPA 101 - Life Safety Code

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. SPECIAL WARRANTY: The Special Warranty shall include as a minimum the following:

1. A written 5-year on-site replacement material, fixture finish and workmanship. On-site replacement includes transportation, removal, and installation of new products. Finish warranty must include warranty against failure or substantial deterioration such as blistering, cracking, peeling, chalking or fading.

2. A written 5-year replacement material warranty for defective or non- starting LED source assemblies.

3. A written 5-year replacement material warranty on all power supply units (PSU).

4. A written 5-year replacement warranty for luminaires producing inadequately maintained illuminance levels at the end of the warranty period, as prorated from levels expected at end of useful life.

5. The warranty period shall begin on the date of Substantial Completion. The CONTRACTOR shall provide the OWNER with appropriate signed warranty certificates. The OWNER shall have received these certificates prior to final payment.

C. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

D. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

E. Provide luminaires from a single manufacturer for each luminaire type.

F. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

   a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

   b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Catalog cuts shall be assembled in a tabbed three ring binder. Each binder shall contain a cover sheet and index listing the sub- mitted items and cross-referenced to the appropriate specification paragraph. Where submittal information for equipment or materials covered by more than one specification Section is included within one binder, each tab shall be submitted as a separate submittal number. The tab shall be labeled with the submittal number.

    d. Where submittals are made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable.

4. Plan: Provide layout and details of exterior lighting assemblies, including relevant information about supporting structure and supported lighting system. Show structural and electrical attachment locations, methods, and components.

5. Product Data: For each type of luminaire indicated, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

    a. Materials and dimensions of luminaire, including Effective Projected Area.
    b. Luminaire materials.
    c. Photoelectric relays.
    d. Drivers, including energy-efficiency data.
    e. LED's, including life, output, CCT, CRI, lumens, and energy-efficiency data.
    f. Certified results of laboratory tests for luminaire photometric performance.

6. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

    a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lithonia
2. Holophane
3. Dialight

4. Hubbell
5. Or Approved Equal.

B. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Lighting Fixture Schedule located on the Drawings.

2.2 LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, appurtenances, base, anchorage and foundation.

C. Wind Load Strength of Support Assembly: Wind load strength of support assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 100 mph (160 km/h) with a gust factor of 1.3.

D. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

E. Metal Parts: Corrosion resistant aluminum, free from burrs, sharp corners, and edges.

F. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

H. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens.

I. Exposed Hardware Material: Stainless steel.

J. Hangers for pendant fixtures are to be rigid type; with not less than five-threaded engagement turns at each end. A safety factor of 4 shall be used in sizing anchors and hangers.

K. Light Shields, where required: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

L. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

M. Reflecting Surfaces: which are painted shall be baked white enamel or manufacturer standard color, two coats minimum with an average reflectance of 90% or greater.

N. Lenses, Diffusers, Covers, and Globes; High resistance to yellowing and other changes due to aging, UV stabilized. 100% virgin acrylic plastic or annealed crystal glass.

O. Lenses and Refractors Gaskets: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.

P. Luminaire Finish: Painted parts shall be water-based coatings and shall be low VOC. Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process, and color of pole or support materials.

Q. Photoelectric Relays: As follows:

1. Contact Relays: Single throw, arranged to fail in the on position and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.

2. Relay Mounting: In luminaire housing.

R. Provide thermal protection.

S. Provide a scope mounting for each fixture and one aiming scope for aiming of all floodlight fixtures.

T. Lighting design is the primary element of an electrical design that affects system efficiency. Evaluate available lighting fixtures on a life cycle cost basis to determine the most appropriate technology for each application.

U. Finish: Match finish of pole/support structure for arm, bracket, and tenon mount materials.

2.3 LED DRIVERS

A. Class 1, constant current.
B. Power factor >90% at full load.
C. THD <20%.
D. Integral surge protection in accordance with ANSI C62.41.2.
E. Minimum 5-year warranty.

2.4 LED LAMPS

A. Color temperature range from 3500K – 5500K based on specific project parameters.
B. CRI >80.
C. Lumens per watt >80.
D. Minimum 70,000-hour life at above 70% rated light output.

2.5 EXTERIOR LUMINAIRE FIXTURE SCHEDULE

A. Refer to Fixture Schedule on the Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Luminaire Attachment: Comply with luminaire manufacturer's mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated. Fasten to indicated structural supports.

1. Fixture shall be level, in straight lines, aligned, and coordinated with ceiling construction and other trades.

2. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

B. Provide fuses mounted in fuse holder. Where fixed fuse holder is not provided standard by manufacturer, provide in-line fuse holder such as Bussmann HFB, Littelfuse, Or Approved Equal, accessible through standard handhole and furnish with enough slack wire to extract the fuse holder for servicing.

C. Luminaire Attachment with Adjustable Features or Aiming: Attach luminaires and supports to allow aiming for indicated light distribution.

3.2 CONNECTIONS

A. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

A. Comply with Section 26 05 53 - Electrical Identification.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged units.

B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests and Observations: Verify normal operation of luminaires after installing and energizing circuits with normal power source, and as follows:

1. Measure light intensities at night if specific illumination performance is indicated. Use photometers with calibration referenced to NIST standard SP-250 or other relevant NIST publication.

2. Check intensity and uniformity of illumination.

E. Prepare a written report of tests, inspections, observations and verifications indicating and interpreting results.

F. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.

2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3. Adjust the aim of luminaires in the presence of the Owner or Owner’s representative.

END OF SECTION

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SECTION 31 05 13 - SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes range of soil and subsoil materials intended to be referenced by other sections, generally for fill and grading purposes. Materials are indicated by "Type" to assist in referencing from other sections and on the DRAWINGS notes.

B. Section includes:

1. Subsoil materials
2. Topsoil materials

1.2 RELATED SECTIONS

A. Section 31 05 16 - Aggregates for Earthwork
B. Section 31 23 16 – Excavation
C. Section 31 23 17 - Trenching
D. Section 31 23 23 - Fill

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

B. ASTM International (ASTM):

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

1. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

2. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

3. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Materials Source: Submit name of imported materials source.
C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish materials of each type from same source throughout the WORK.

B. Soil Testing:

1. Soil sampling and testing to be completed by an independent laboratory approved by the ENGINEER.

2. Frequency of testing shall be determined by the ENGINEER.

3. All soil testing shall be paid for by the CONTRACTOR.

C. Compaction Tests:

1. Maximum density at optimum moisture content determined by ASTM D1557 (AASHTO T180).

2. In-place density in accordance with Nuclear Testing Method, ASTM D6938.

D. Soil Classification: All imported materials shall be classified in accordance with ASTM D2487.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Subsoil Type S1, Select Native Material:

1. Select earth obtained from on-site excavations approved for use by ENGINEER.

2. Graded.

3. Free of peat, humus, vegetative matter, organic matter and rocks larger than 6 inches in diameter.

4. Processed as required to be placed in thickness as prescribed and at the optimum moisture content to obtain level of compaction required by these SPECIFICATIONS.

B. Subsoil Type S2, Imported Fill Material:

1. Imported earth approved for use by ENGINEER.
2. Meeting the requirements of Subsoil Type S1.

2.2 TOPSOIL MATERIALS

A. Topsoil Type TS1, Select Native Topsoil Material:

1. Top 6 - 12 inches of existing soil containing organic matter.

2. ENGINEER decision shall be final as to determination of what material is topsoil quality.

3. Graded.

4. Free of roots, rocks larger than 1/2-inch subsoil, debris, large weeds, and foreign matter.

    a. Screening: Single screened.

B. Topsoil Type TS2, Imported Topsoil Material:

1. Imported borrow.

2. Friable loam.

3. Reasonably free of roots, rocks larger than 1/2-inch, subsoil, debris, large weeds, and foreign matter.

    a. Screening: Single screened.

4. Acidity range (pH) of 5-1/2 to 7-1/2.

5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.

2.3 SPOILS

A. All excess material not suitable or not required for backfill and grading shall be hauled off site and disposed of at a location provided by the CONTRACTOR and approved by the ENGINEER.

B. Make arrangements for disposal of the material at no additional cost to the OWNER.

C. Landfill permit to be obtained by the CONTRACTOR and provided to ENGINEER prior to commencement of disposal.

2.4 SOURCE QUALITY CONTROL

A. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D1557 (AASHTO T180).

B. When tests indicate materials do not meet specified requirements, change material or vary compaction methods and retest. Additional testing shall be completed and paid for by the CONTRACTOR with no reimbursement by the OWNER.

C. Furnish materials of each type from same source throughout the WORK.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate material of every nature and description to the lines and grades as indicated on the DRAWINGS and/or as required for construction of facilities.

B. Site within clearing limits shall be stripped of topsoil as required to obtain additional topsoil necessary to complete WORK indicated in the DRAWINGS or as specified.

C. When practical, do not excavate wet topsoil.

D. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

E. Remove excess excavated subsoil and topsoil not intended for reuse from Site.

F. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from Site.

3.2 STOCKPILING

A. Stockpile soils at locations shown in the DRAWINGS or at locations as approved by ENGINEER for redistribution as specified.

1. Site may not have sufficient area to stockpile excavated material that will be required for fill later in the project. If additional stockpile area is required to complete the Project on schedule, arrange off-site stockpile areas.

2. No additional payments will be made for stockpiling excavated materials off-site.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Prevent intermixing of soil types or contamination.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

1. Grade surface of stockpiles to prevent ponding of water.
2. Cover stockpiles to minimize the infiltration of water.

F. Stockpile unsuitable and/or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 05 16 - AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes a range of coarse and fine aggregate materials intended to be referenced by other Sections, generally for fill and grading purposes. Materials are indicated by "Type" to assist in referencing from other Sections and in the DRAWINGS notes.

B. Section Includes:

1. Coarse aggregate materials
2. Fine aggregate materials

1.2 RELATED SECTIONS

A. Section 31 05 13 - Soils for Earthwork
B. Section 31 23 17 - Trenching
C. Section 31 23 23 - Fill

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses

2. AASHTO T27 - Sieve Analysis of Fine and Coarse Aggregates

3. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

4. AASHTO TP61 - Standard Method of Test for Determining the Percentage of Fracture in Coarse Aggregate

B. ASTM International (ASTM):

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

4. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

5. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Materials Source: Submit name of imported materials suppliers.
C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
D. Results of aggregate sieve analysis and standard proctor tests for all granular material.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the WORK.

B. Aggregate Testing:

1. Aggregate sampling and testing to be completed by an independent laboratory approved by the ENGINEER.

2. The frequency of testing shall be determined by the ENGINEER.

3. All aggregate testing shall be paid for by the CONTRACTOR.

C. Compaction Tests:

1. Maximum density at optimum moisture content determined by AASHTO T180.
2. In-place density in accordance with Nuclear Testing Method, ASTM D6938.

D. Aggregate Classification: All imported materials shall be classified in accordance with ASTM D2487.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Coarse Aggregate Type A1, Dense-Graded Aggregate: Crushed rock with ¾-inch-0, 1-inch-0, 1-1/2-inch-0, 2-inch-0 and 2-1/2-inch-0 gradation as shown in the DRAWINGS and meeting the requirements provided below.

1. Grading - Dense-graded base aggregate shall be crushed rock, including sand. Uniformly grade the aggregates from coarse to fine.

2. Sieve analysis shall be determined according to AASHTO T27.

3. The aggregates shall conform to one of the grading requirements Table 31 05 16-A below.

Table 31 05 16-A
Grading Requirements for Dense-Graded Aggregate
Separated Sizes
Percent Passing (by weight)

Sieve Size	2-1/2" - 0	2" - 0	1-1/2" - 0	1" - 0	3/4" - 0
3”	100				
2-1/2”	95 - 100	100			
2”	-	95 - 100	100		
1-1/2"	-	-	95 - 100	100	
1-1/4”	55 - 75	-	-	-	
1”	-	55 - 75	-	90 - 100	100
3/4"	-	-	55 - 75	-	90 - 100
1/2"	-	-	-	55 - 75	-
3/8”	-	-	-	-	55 - 75
1/4"	30 - 45	30 - 45	35 - 50	40 - 55	40 - 60
No. 4*	-	-	-	-	-
No. 10	[1]	[1]	[1]	[1]	[1]

[1] Of the fraction passing the 1/4-inch sieve, 40 percent to 60 percent shall pass the No. 10 sieve.
* Report percent passing sieve when no grading requirements are listed.

4. Fracture of Rounded Rock:

   a. Determined according to AASHTO TP61.

   b. Provide at least one fractured face based on the following percentage of particles retained on the 1/4-inch sieve for the designated size:

Minimum Percent of Fractured Particles
by Weight of Material

Designated Size	Retained on 1/4-Inch Sieve
1-1/2-inch – 0 and larger	50
Smaller than 1-1/2-inch – 0	70

5. Durability:

   a. Crushed rock aggregate shall meet the following durability requirements:

Test	Test Method	Requirements
Abrasion	AASHTO T 96	35.0 percent maximum
Degradation (Coarse Aggregate)	ODOT TM 208	30.0 percent maximum
Passing No. 20 Sieve, Sediment Height	ODOT TM 208	3.0-inch maximum

6. Sand Equivalent -- Crushed rock aggregate will be tested according to AASHTO T 176 and shall have a sand equivalent of not less than 50.

B. Coarse Aggregate Type A2, Granular Drain Backfill Material: Crushed or uncrushed rock or gravel as shown in the DRAWINGS.

1. Material shall be clean and free draining.
2. Sieve analysis shall be according to AASHTO T27.
3. Grading: Meeting the gradation requirements provided in Table 31 05 16-B below.

Table 31 05 16-B
Grading Requirements for Granular Drain Backfill Material
Separated Sizes
Percent Passing (by weight)

Sieve Size	Separated Sizes 1-1/2-inch – 3/4-inch	Separated Sizes 3/4-inch – 1/2-inch
2-inch	100	
1-1/2-inch	90 - 100	
1-inch	20 - 55	100
3/4-inch	0 - 15	85 - 100
1/2-inch	-	0 - 15
3/8-inch	0 - 5	-

2.2 SAND

A. Sand: Sand material shall consist of granular material, naturally produced or produced from crushed gravel, or dredge sand that is reasonably free of organic material, mica, clay, fly ash, and other deleterious material, meeting the gradations of Table 31 05 16-C below.

Table 31 05 16-C
Grading Requirements for Sand
Separated Sizes
Percent Passing (by weight)

Sieve Size	Coarse Sand	Medium Sand	Fine Sand
1-inch	100	100	100
3/8-inch	95 - 100	95 - 100	-
#4	80 - 100	70 - 95	90 - 100
#30	10 - 30	10 - 45	-
#100	-	2 - 10	2 - 10
#200	0 - 8	0 - 7	0 - 4
Sand Equivalent	50 min.	50 min.	50 in.

2.3 SOURCE QUALITY CONTROL

A. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM C136 and AASHTO T180.

B. Sand - Testing and Analysis: Perform in accordance with ASTM C136 and AASHTO T180.

C. When tests indicate materials do not meet specified requirements, change material and retest. Additional testing shall be completed and paid for by the CONTRACTOR with no reimbursement by the OWNER.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile materials imported to site as shown in the DRAWINGS or at locations as approved by ENGINEER for redistribution as specified.

B. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

C. Prevent intermixing of aggregate types or contamination.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

1. Grade surface of stockpiles to prevent ponding of water.
2. Cover stockpiles to minimize the infiltration of water.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

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SECTION 31 23 16 - EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes excavation required for building foundations, site structures, or under slabs-on-grade or paving. Excavating for utilities outside building is included in Section 31 23 17, Trenching.

B. Section Includes:

1. Excavating for building foundations
2. Excavating for paving, roads, and parking areas
3. Excavating for slabs-on-grade
4. Excavating for site structures
5. Excavating for landscaping

1.2 RELATED SECTIONS

1. Section 01 45 00 - Quality Control
2. Section 02 41 00 - Demolition
3. Section 31 05 13 - Soils for Earthwork
4. Section 31 05 16 - Aggregates for Earthwork
5. Section 31 23 17 - Trenching
6. Section 31 23 23 - Fill

1.3 DEFINITIONS

A. Common Excavation: All excavation required for WORK, regardless of the type, character, composition, or condition of the material encountered. Common Excavation shall further include all debris, junk, broken concrete, and all other material. All excavation shall be classified as Common Excavation, unless provided as Rock for under Section 31 23 18, Rock Removal below.

B. Common Material: All soils, aggregate, debris, junk, broken concrete, and miscellaneous material encountered in Common Excavation, excluding rock as defined below.

C. Contaminated Soil and Material: Soil, water, free product, Underground Storage Tanks (UST), buried abandoned utility lines containing residual or free product, solid waste, treated wood waste, chemical containers, or other solid, liquid, or gas substances with contamination levels above background levels. Untested soils within the top 18 inches of soil within the ODOT ROW are considered contaminated.

D. Concrete Excavation: The removal of pieces of concrete larger than 1 cubic yard in volume that requires drilling, splitting and breaking methods, or a necessitating a trench width increase of 18 inches or more than the width of the preceding 10 feet of trench. Concrete excavation includes materials composed of Portland cement that are not identified other than manholes, structures, sewer pipe, or other appurtenances.

E. Exploratory Excavation: The removal and replacement of material from locations shown on the DRAWINGS, or as directed for the purpose of investigating underground conditions and identifying potential utility conflict between existing and proposed utilities.

F. Overbreak: Material beyond and outside of the slope limits established by the OWNER's Representative, which becomes displaced or loosened during excavation and is excavated.

G. Pothole Excavation: Pothole excavation is the removal and replacement of all materials via coring, vacuum extraction, or similar method, not classified as exploratory excavation, for the purposes of locating an underground utility and to investigate underground conditions.

H. Spoils: Excavated materials from Site unsuitable for use as fill or not required for backfill and grading.

I. Unsuitable Materials: See Spoils.

1.4 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: At a minimum, to include the following:

1. Methods and sequencing of mass excavation.
2. Proposed onsite and off-site spoil disposal locations.
3. Anticipated difficulties and proposed resolutions.
4. Proposed routes for OWNER's access to OWNER's facilities impacted by excavation WORK.
5. Proposed haul routes.

B. Excavation support plan and utility protection plan if needed.

1.6 QUALITY ASSURANCE

A. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

B. Provide adequate survey control to avoid unauthorized over-excavation.

C. Weather Limitations:

1. Material excavated when frozen or when air temperature is less than 32 degrees Fahrenheit (F) shall not be used as fill or backfill until material completely thaws.

2. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Prior to commencing work in this Section, become familiar with site conditions. In the event discrepancies are found, notify the ENGINEER as to the nature and extent of the differing conditions.

B. Call Local Utility Line Information service at 1-800-332-2344 not less than 3 working days before performing WORK.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Coordinate with and notify utility companies should it be necessary to remove or relocate facilities.

C. Identify required lines, levels, contours, and datum.

D. Protect existing utilities, survey control, plant life, and landscaped areas in coordination with WORK in this Section.

3.2 SITE CONDITIONS

A. Quantity Survey: The CONTRACTOR shall be responsible for calculations for quantities and volume of cut and fill from existing site grades to finish grades established under this contract as indicated in the DRAWINGS or specified and shall include the cost for all earthwork in the total basic bid.

B. Dust Control: Must meet all federal, state, and local requirements. Protect persons and property from damage and discomfort caused by dust. Water surfaces as necessary and when directed by ENGINEER to quell dust.

C. Soil Control: Soil shall not be permitted to accumulate on surrounding streets or sidewalks nor to be washed into sewers.

D. Contaminated Material Control: Contaminated soil shall be handled separately from all other material types on site with measures put into place to prevent further spread of contaminants.

3.3 EXISTING UNDERGROUND UTILITIES

A. Protect active utilities encountered, located or otherwise, and notify persons or agencies owning same.

B. Remove inactive or abandoned utilities from within the project grading limits in accordance with Section 33 11 50, Existing Pipe Abandonment.

C. For sewer and other miscellaneous drainage facilities, fill and plug pipes as follows:

1. General:

    a. Remove all structures to a minimum of 3 feet below subgrade, unless otherwise noted.

    b. Cover top surface of all abandoned structures with two sheets of nonwoven geotextile, extended at least 1-foot beyond the outside walls of the abandoned manhole, sump, or basin.

    c. Plug all abandoned pipes with permanent plugs as specified in Section 33 11 50, Existing Pipe Abandonment.

2. Sumps:

    a. Remove existing sediment, soil, and water. Properly dispose of these materials in accordance with the requirements of these SPECIFICATIONS.

    b. Remove top cone and first solid concrete section to a depth of approximately 8 to 10 feet below ground.

    c. Fill sump with CLSM.

    d. Backfill remaining voids for facilities within existing or proposed roadways with approved materials meeting the requirements of Section 31 05 16 Aggregates for Earthwork.

3. Salvaging Manhole Frames, Covers, and Grates:

    a. Remove manhole frames, covers, and grates scheduled for salvage and store in approved location.

    b. Frames, grates, and covers meeting SPECIFICATIONS may be salvaged from structures to be adjusted and may be reused in the WORK if of suitable size and condition.

    c. Replace, at no additional cost to the OWNER, all items damaged or lost by the CONTRACTOR with similar items that are comparable in all respects with those they are to replace, and which are adequate for the intended purpose.

    d. Clean salvaged components to be reused of foreign material by methods that will not harm the components.

4. Existing Manhole Frames and Covers: Manhole frames and covers removed by the CONTRACTOR are the property of the OWNER. Notify the ENGINEER a minimum of 48 hours before removal to arrange for pickup of the removed frames and covers, if not reused.

3.4 PRESERVATION OF EXISTING IMPROVEMENTS

A. Protect adjacent existing structures which may be damaged by excavation work.

1. Conduct operations in such a manner that existing street facilities, utilities, railroad tracks, structures, and other improvements, which are to remain in place, will not be damaged. Furnish and install cribbing and shoring or whatever means necessary to support material

around existing facilities, or to support the facilities themselves, and maintain such supports until no longer needed.

2. Open slopes shall not be cut within 5 feet of any existing spread footings unless approved by the ENGINEER.

3. Do not interfere with 45 degree bearing splay of foundations unless approved by the ENGINEER

4. Excavated material shall not be placed adjacent to existing or proposed structures.

3.5 DISCOVERY OF CONTAMINATED SOILS OR MATERIALS

A. CONTRACTOR shall note evidence of contamination (odor, visual staining of soil, free liquid product seeping from soil, sheen on groundwater, etc.) and note location of evidence on a sketch of the excavation and provide to the ENGINEER.

B. CONTRACTOR shall report the discovery to the ENGINEER immediately. CONTRACTOR shall stop all excavation activities and secure the site to prevent entry by the public. The excavation shall not be backfilled. Protect all open excavations with berms, plates and fencing. CONTRACTOR may continue with work in other non-contaminated areas.

C. CONTRACTOR shall collect sample(s) of suspected contaminated and coordinate testing and characterization. CONTRACTOR shall allow 21 days, at no cost to OWNER, for testing, results and instruction as to how to proceed with contaminated materials.

D. CONTRACTOR shall obtain a copy of an approved soil disposal/acceptance permit

3.6 EXCAVATION

A. General:

1. Method of excavation shall be the CONTRACTOR's option, but care shall be exercised as final grade is approached to leave it in undisturbed condition.

2. If the final grade for supporting structures is disturbed, it shall be restored to requirements of these SPECIFICATIONS and satisfaction of the ENGINEER at no additional cost to OWNER.

3. The CONTRACTOR is advised that footings should be poured as soon as possible to minimize unfavorable final grade conditions from developing.

4. Provide all measures to ensure public safety.

B. Control of Water:

1. Provide and maintain equipment to remove and dispose of water during the course of the WORK of this Section and keep excavations dry and free of frost or ice.

2. Bearing surfaces that become softened by water or frost must be re-excavated to solid bearing at CONTRACTOR's expense and backfilled with compacted crushed rock at CONTRACTOR's expense.

3. Grade top perimeter of excavation to prevent surface water from draining into excavation.

C. Frozen Ground: Frost protection shall be provided for all structural excavation work. Foundation work shall not be placed on frozen ground.

D. Excavate material of every nature and description to the lines and grades as indicated in the DRAWINGS and/or as required for construction of the facility.

1. Allow for forms, shoring, working space, granular base, topsoil, and similar items, wherever applicable.

2. Trim excavations to neat lines. Remove loose matter and lumped subsoil.

E. Excavated Materials: Soils excavated at Site will be treated and used as one of three general categories of material as provided below.

1. Fill:

a. Subsoil Type S1, Select Native Fill, as approved for use by ENGINEER.

2. Spoils:

a. Ensure there is sufficient suitable material available to complete embankments and other required fillings prior to disposing of any excavated materials.

b. Make arrangements for disposal of spoils and include as part of contract work in preparing of project bids.

c. Landfill permit or written permission from private property OWNER to be obtained by the CONTRACTOR and provided to the ENGINEER.

3. Contaminated Soils and Materials:

a. Contaminated soil sourced from the top 18 inches of the existing soil grade on site may be used for backfill and grading, all other contaminated soil shall be disposed of offsite.

b. Prior to removal from site, contaminated soils shall be tested to confirm contamination type and the CONTRACTOR must obtain a disposal/acceptance permit from an ENGINEER approved disposal or treatment facility.

c. Transport of contaminated soils and materials shall comply with all applicable Federal, State, or local laws, codes, and ordinances that govern or regulate contaminated substance transportation. The contractor shall not allow contaminated substances to be spilled or tracked off-site at any time during the project.

F. Shoring:

1. The CONTRACTOR shall be solely responsible for excavation protection and worker safety and shall provide sheeting and shoring wherever required, all in accordance with current local, state, and federal laws, codes, and ordinances.

2. Where shoring, sheet piling, sheeting, bracing, lagging, or other supports are necessary to prevent cave-ins or damage to existing structures, it shall be the responsibility of the CONTRACTOR to design, furnish, place, maintain, and remove such supports in accordance with applicable ordinances and safety requirements.

3. The design, planning, installation, and removal of all sheeting accomplished in such a manner as to maintain the undisturbed state of the soil below and adjacent to the excavation.

G. Slope existing banks with machine to angle of repose or less until shored.

1. Shape, trim, and finish cut slopes to conform to lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

2. Protection of excavation side slopes:

a. Use excavation methods that will not shatter or loosen excavation slopes.

b. Where practical, excavate materials without previous loosening and in limited layers or thickness to avoid breaking the material back of the established slope line.

c. Avoid overbreaks. Overbreak is incidental to the WORK, except in cases where the OWNER's Representative determines that such overbreak was unavoidable.

d. Excavation in rock or rocky cuts:

1) Once completed, thoroughly test the slopes with bars or other approved means to remove all loose, detached, broken, or otherwise unstable material.

2) Remove jutting points. Scale slopes using mine scaling rods or other approved methods to remove loose or overhanging materials and provide a safe, trim, neat, and stable condition.

3) Dispose of the materials removed under this subparagraph in the same manner as other excavated material.

e. Remove all exposed roots, debris, and all stones more than 3 inches in size which are loose or could become loosened.

3. Construct slopes free of all exposed roots.

4. Construct slopes free of unstable rock and loose stones exceeding 3 inches in diameter.

5. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend off-site, outside of easements, outside of rights-of-way, or adversely impacts existing facilities, adjacent property, or completed WORK.

6. Trim all surfaces neatly and smoothly.

H. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 17, Trenching and Section 31 23 23, Fill.

I. Notify ENGINEER of unexpected subsurface conditions.

J. Over-excavation for Unsuitable Foundation Conditions:

1. Cross-sectional dimensions and depths of excavations shown in the DRAWINGS shall be subject to such changes as may be found necessary by the ENGINEER to secure foundations free from soft, weathered, shattered, and loose material or other objectionable materials.

2. Unsuitable materials encountered shall be removed and replaced with Coarse Aggregate Type A1, 2-1/2-inch – 0 gradation, as specified in Table 31 05 16-A of Section 31 05 16, Aggregates for Earthwork. All material placed shall be compacted to 95 percent of maximum dry density.

3. Unsuitable materials shall be removed and replaced only as directed in writing by ENGINEER.

K. Rock Removal:

1. Remove boulders and rock up to 1/2 cubic yard measured by volume per the requirements of this Section.

2. Remove larger boulders and rock material as necessary.

3. Concrete removal, as defined herein, shall be treated as Rock Removal.

L. Stockpile excavated material in area(s) designated on or off site in accordance with Section 31 05 13, Soils for Earthwork.

3.7 FIELD QUALITY CONTROL

A. Perform excavation and controlled fill operations in accordance with the requirements of this Section.

B. Coordinate the visual inspection and approval of all bearing surfaces by ENGINEER before installing subsequent work.

3.8 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability and store excavated materials at a distance from top of excavation.

B. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 23 17 - TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for excavation and backfill of all utilities, including installation of pipe bedding, pipe zone backfill, trench backfill, and related WORK as shown on the DRAWINGS and as specified.

B. Section includes:

1. Excavating trenches for pipe, utility vaults, and other utilities.
2. Compacted fill from top of utility bedding to final grades.
3. Trench and utility vault backfilling and compaction.

C. Related Sections

1. Section 01 45 00 - Quality Control
2. Section 03 11 00 – Concrete Work
3. Section 31 05 13 - Soils for Earthwork
4. Section 31 05 16 - Aggregates for Earthwork
5. Section 31 23 16 - Excavation
6. Section 31 23 23 - Fill
7. Section 31 23 24 - Flowable Fill
8. Section 33 31 10 - Sanitary Utility Sewerage Piping

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

B. ASTM International (ASTM):

1. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

6. D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.3 DEFINITIONS

A. Controlled Low Strength Material (CLSM): Also referred to as Flowable Fill. Lean cement concrete fill. A self-compacting, cementitious material.

B. Flexible Pipe: For the purposes of these SPECIFICATIONS, tubing between 1/2-inch and 4-inch diameter constructed of polyvinyl chloride (PVC) and high-density polyethylene (HDPE) are considered flexible pipes. HDPE piping 4 inches in diameter and larger is also considered flexible pipe.

C. Geosynthetics: Geotextiles, geogrids, geomembranes, and drainage composite materials.

D. Imported Material: Materials obtained from sources offsite, suitable for specified use.

E. Lift: Loose (uncompacted) layer of material.

F. Obstructions: Items which may be encountered during utility and vault trenching which do not require replacement.

G. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

H. Pipe Bedding: Trench backfill zone for full trench width which extends from the bottom outside surface of the pipe to a minimum of 6 inches below the bottom outside surface of pipe, conduit, cable, or duct bank to the trench foundation so as to uniformly support the barrel of the pipe.

I. Pipe Zone: Trench backfill zone for full trench width which extends from the bottom outside surface of the pipe to a minimum of 12 inches above the top outside surface of pipe, conduit, cable, or duct bank.

J. Pipe Bedding, Pipe Zone, and Trench Backfill Classifications:

1. Class A: Backfill with suitable native or imported material that is approved to meet the characteristics required for the specific surface loading or other criteria of the backfill zone.

2. Class B: Backfill with imported granular material consisting of gravel or crushed rock meeting the requirements of this Section and Coarse Aggregate Type A1 as specified in Section 31 05 16, Aggregates for Earthwork; typical designated size shall be 1-inch-0 or 3/4-inch-0.

3. Class C: Backfill with Fine Sand, as specified in Section 31 05 16, Aggregates for Earthwork.

4. Class D: Backfill with approved pit run or bar run material, well-graded from coarse to fine; maximum dimension shall be 3 inches.

5. Class E: Backfill with CLSM. See Section 31 23 24, Flowable Fill.

K. Pothole Excavations: Removal and replacement of all materials via coring, vacuum extraction, or similar method for the purposes of locating an underground utility and to investigate underground conditions.

L. Prepared Trench Bottom: The bottom of the trench on which the pipe bedding is to lie and which provides support for the pipe.

M. Relative Compaction: Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM Standards.

N. Rigid Pipe: For the purposes of these SPECIFICATIONS, pipe constructed of PVC, ductile iron, steel, concrete, and clay pipes are considered rigid pipes.

O. Sewer, Pipes, and Mains: Conduits of circular or other geometric shapes, used to convey liquids or gases, or other material.

P. Trench Backfill: Trench backfill zone for full trench width extending from the top of the pipe zone to pavement base rock, ground surface, or other surface material.

Q. Trench Stabilization: Removal of unsuitable material in the bottom of a trench and replacement with specified material for support of a pipe, main, conduit, structure, or appurtenances.

R. Utility: Any buried pipe, duct, conduit, or cable.

S. Well-Graded: A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: At a minimum, to include the following:

1. Methods and sequencing of mass excavation.
2. Proposed on-site and off-site spoil disposal locations.
3. Anticipated difficulties and proposed resolutions.
4. Proposed routes for OWNER's access to OWNER's facilities impacted by excavation Work.
5. Proposed haul routes.

B. Excavation support plan and utility protection plan as specified in Section 31 50 00, Excavation Support and Protection.

C. Product Data:

1. Geotextile fabric, indicating fabric and construction
2. Marking tapes

3. Tracer wire
4. Connectors for tracer wire and/or marking tapes
5. Tracer wire locate boxes
6. Marker balls
7. Locator stations
8. Ground wires
9. Plastic or copper markers for service laterals.

D. Imported Materials:

1. Materials Source: Submit name and location of imported fill materials suppliers.

2. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3. Submit results of aggregate sieve analysis and standard proctor test for granular material.

E. CLSM: Mix designs in accordance with Submittal requirements of Section 31 23 24, Flowable Fill.

F. Concrete: Mix designs in accordance with Submittal requirements of Section 03 11 00, Concrete Work.

1.5 QUALITY ASSURANCE

A. Subsoil and topsoil fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 13, Soils for Earthwork.

B. Aggregate fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 16, Aggregates for Earthwork.

C. CLSM:

1. In-place testing: In accordance with ASTM C403.
2. Compressive testing: In accordance with ASTM D4832.

D. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

1.6 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

B. Coordinate trenching and utility installation work with other work at utility construction location occurring near or adjacent to specified herein.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Native Backfill: Type S1, Select Native Material as specified in Section 31 05 13, Soils for Earthwork.

B. Trench Backfill and Pipe Zone Material: Coarse Aggregate Type A1, Dense-Graded Aggregate with gradation as shown in the DRAWINGS and specified in Section 31 05 16, Aggregates for Earthwork.

C. Concrete:

1. Lean concrete as specified in Section 31 23 24, Flowable Fill, with compressive strength of 100 pounds per square inch (psi).

2. Structural concrete as specified in Section 03 11 00, Concrete Work with compressive strength of 3,000 psi.

D. Drain Rock: Coarse Aggregate Type A2, Granular Drain Backfill Material with gradation as shown in the DRAWINGS and specified in Section 31 05 16, Aggregates for Earthwork.

E. Sand: As specified in Section 31 05 16, Aggregates for Earthwork.

F. Trench Stabilization Material: Coarse Aggregate Type A1, Dense-Graded Aggregate, 2-1/2-inch - 0 gradation as specified in Section 31 05 16, Aggregates for Earthwork.

2.2 MARKING TAPE

A. Detectable:

1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.

2. Foil Thickness: Minimum 0.35 mils.

3. Laminate Thickness: Minimum 5 mils.

4. Width: 6 inches.

5. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.

6. Joining Clips: Tin or nickel-coated furnished by tape manufacturer.

7. Manufacturers and Products:

a. Reef Industries; Terra Tape, Sentry Line Detectable
b. Mutual Industries; Detectable Tape
c. Presco; Detectable Tape

B. Color: In accordance with APWA Uniform Color Code for Temporary Marking of Underground Facilities and as specified in NEMA Z535.1, Safety Color Code.

Color	Facility
Red	Electric power lines, cables, conduit, and lightning cables
Orange	Communicating alarm or signal lines, cables, or conduit
Yellow	Gas, oil, steam, petroleum, or gaseous materials
Green	Sewers and drain lines

Color	Facility
Blue	Potable water
Purple	Reclaimed water, irrigation, and slurry lines

2.3 ELECTRONIC LOCATING MATERIALS

A. Marker Balls:

1. Exterior Material: High-density polyethylene.

2. Size: Maximum 4-1/2 inches in diameter.

3. Range: Locatable with standard electronic marker locating devices at depths up to 5 feet.

4. Field Type: Spherical RF field regardless of orientation.

5. Contain no floating or movable parts, and no batteries or active components.

6. Color: Provide colored marker balls per Article 2.03 B above.

7. Manufacturer and Product: Omni Marker Model 162 (green), Omni Marker Model 161 (blue), or approved equal.

B. Tracer Wire:

1. Direct burial No. 12 AWG solid, annealed copper-clad steel (CCS) high strength tracer wire.

2. Tensile Breaking Load: 380-pound average.

3. Jacket:

a. High molecular weight high-density polyethylene complying with ASTM D1248, 30-volt rating.

b. Color: Provide in colors per Article 2.03 B above.

4. Manufacturer and Product: Copperhead Industries; LLC, 12 CCS high strength reinforced tracer wire, or approved equal.

C. Tracer Wire Connectors:

1. Waterproof, corrosion proof and suitable for No. 12 AWG solid core wire.

2. Prefilled with silicone and suitable for use with low-voltage tracer lines of less than 50 volts.

3. Lug Connectors:

a. Waterproof plastic housing that encases the silicone prefilled lug terminals.
b. Manufacturer and Product: King Innovations; DryConnTM Direct Bury Lug or approved equal.

4. Twist Connectors:

    a. Waterproof epoxy-filled packaging that encases the silicone prefilled twist connectors.

    b. Manufacturer and Product: 3M Division; DBY Direct Bury Splice Kit 09053 connectors or approved equal.

D. Ground Wire: No. 12 AWG bare solid copper wire.

E. Locator Station:

1. Test Station:

    a. Lexan® polycarbonate.
    b. Color: Provide in colors per Article 2.03 B above.

2. Terminals suitable for No. 12 AWG leads.

3. Use single (two lead) locator stations with two terminals, one for ground wire and one for tracer wire, when only one tracer wire is terminated in manhole.

4. Use multi-lead locator stations with the appropriate number of terminals when 2 or more tracer wire leads are terminated in manhole.

5. Manufacturer and Product: Cott Manufacturing Company; FlangeFink® Cathodic Protection Test Station.

2.4 VISUAL IDENTIFICATION MATERIALS

A. Tracer Wire Locate Boxes:

1. Material: Polyolefin.

2. Cover:

    a. Color: Provide in colors per Article 2.03 B above.

    b. Provide box cover identification marking for facility type such as “Sewer Locate Wire”, as approved by OWNER.

    c. Locking type with a nominal 6-inch opening.

3. Manufacturer and Product: Carson Industries LLC; L Series Model 708 or approved equal.

B. Service Lateral Plastic or Copper Markers:

1. Service Lateral Plastic or Copper Markers: Use markers of the type that requires installation to be recessed below grade.

    a. Material: Plastic or copper. In new concrete, use “new construction” markers; in existing concrete use “retrofit” markers and use adhesive recommended by the manufacturer.

b. Plastic Pavement Markers:

1) UV stabilized and fade resistant.

2) Material: Meet or exceed a tensile strength of 3,500 psi, and meet test requirements as outlined in ASTM G53, Standard Practice for Light and Water Exposure of Nonmetallic Material.

3) Color: Provide in color per Article 2.03 B above with the words, "WARNING, BURIED [UTILITY TYPE], Call Before You Dig," molded to the top of marker.

a) Provide wording for specific facility as approved by OWNER.

4) Manufacturer and Product: Rhino Marking and Protective Systems; A-TAG pavement markers or approved equal.

c. Copper Pavement Markers:

1) Material: Copper material chosen by manufacturer.

2) Diameter: 1-5/32-inch.

3) Wording: Provide facility identification wording stamped on the top such as "Sewer Lateral" as approved by OWNER.

4) Manufacturer and Product: Berntsen Concrete Marker; BP2-U or approved equal.

C. Service Lateral 2-inch by 4-inch Markers:

1. S4S Douglas fir, pressure-treated 2-inch by 4-inch lumber, utility grade or better.
2. Grade stamped by an American Lumber Standards certified inspection agency.

PART 3 EXECUTION

3.1 PREPARATION

A. Call Local Utility Line Information service at 1-800-332-2344 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Coordinate with and notify utility companies should it be necessary to remove or relocate facilities.

3. Maintain and protect above and below grade utilities indicated to remain.

B. Identify required lines, levels, contours, and datum locations.

C. DRAWINGS and/or SPECIFICATIONS cover and govern replacement and restoration of foreseeable damage.

D. The site of an open cut excavation shall be first cleared of all obstructions preparatory to excavation in accordance with Section 31 10 00, Site Clearing.

E. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life, and landscaped areas in coordination with Work in this Section.

1. Intent of DRAWINGS and SPECIFICATIONS is that all streets, structures, and utilities be left in condition equal to or better than original condition.

2. Where damage occurs, and cannot be repaired or replaced, the CONTRACTOR shall purchase and install new material, which is satisfactory to OWNER.

F. Potholing / Exploratory Test Pits: Dig such exploratory test pits and perform potholing as may be necessary in advance of trenching to determine the exact location and elevation of subsurface structures, pipelines, duct banks, conduits, and other obstructions which are likely to be encountered or need to be connected to and shall make acceptable provision for their protection, support, and maintenance of their continued operation.

G. Paved or Surfaced Streets:

1. Wherever paved or surfaced streets are cut, saw wheel or approved cutting devices shall be used.

2. Width of pavement cut shall be as shown in the DRAWINGS.

3. Any cut or broken pavement shall be removed from site during excavation.

H. Traffic:

1. Maintain street traffic at all times as required by the DRAWINGS and as specified herein.

2. Erect and maintain barricades, warning signs, traffic cones, and other safety devices during construction in accordance with the latest edition of Manual of Uniform Traffic Control Devices (MUTCD), Part 6, to protect the traveling public in any area applicable.

3. Provide flaggers as required during active work in roadway areas.

I. Operations shall be confined to rights-of-way and easements provided. Avoid encroachment on, or damage to, private property or existing utilities unless prior arrangements have been made with copy of said arrangement submitted to ENGINEER.

3.2 EASEMENTS

A. Where portions of the Work are located on private property, easements and permits will be obtained by the OWNER. Easements shall provide for the use of property for construction purposes to the extent indicated on the easements.

B. Copies of these easements and permits will be available from the OWNER for inspection by the CONTRACTOR. It shall be the CONTRACTOR's responsibility to determine the adequacy of the easement obtained in every case.

C. Confine construction operations to within the easement limits or street right-of-way limits or make special arrangements with the property OWNERs for the additional area required and notify the ENGINEER with a copy of the written approval from property OWNERs of any such conditions.

D. Any damage to private property, either inside or outside the limits of right-of-way or easements provided by the OWNER, resulting from WORK shall be the responsibility of the CONTRACTOR. Before the ENGINEER will authorize final payment, the CONTRACTOR will be required to furnish the OWNER with written releases from property OWNERs where the CONTRACTOR has obtained special agreements or easements or where the CONTRACTOR's operations, for any reason, have not been kept within the construction right-of-way obtained by the OWNER.

3.3 PROTECTION

A. Existing Facilities:

1. It is the intent of these SPECIFICATIONS that all streets, structure, and utilities be left in a condition equal to or better than original condition at the completion of the Project.

2. Where damage occurs, and cannot be repaired or replaced, the CONTRACTOR shall purchase and install new material to the satisfaction to the ENGINEER.

3. DRAWINGS and/or SPECIFICATIONS cover and govern replacement and restoration of foreseeable damage.

B. Removal of Water:

1. As specified in Section 31 23 19, Dewatering.

2. At all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the WORK.

3. Keep all excavations dry until the utilities or vaults to be placed therein are completed. In water bearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation dry as specified.

4. Dispose of water from the WORK in a suitable legal manner without damage to adjacent property or structures.

C. Trench Protection:

1. Provide the materials, labor, and equipment necessary to protect trenches at all times.

2. Trench protection shall provide safe working conditions in the trench and protect the WORK, existing property, utilities, pavement, etc.

3. The method of protection shall be according to the CONTRACTOR's design.

4. The CONTRACTOR may elect to use a combination of shoring, overbreak, tunneling, boring, sliding trench shields, or other methods of accomplishing the WORK provided the method meets the approval of all applicable local, state, and federal safety codes.

5. Damages resulting from improper shoring, improper removal of shoring, or from failure to shore shall be the sole responsibility of the CONTRACTOR.

3.4 LINES AND GRADES

A. Trench excavation for piping, utility vaults, and other utilities shall be performed to the alignment and grade as indicated in the DRAWINGS.

B. Where grades are not shown in the DRAWINGS, utilities shall be laid to grade between control elevations shown.

C. Water mains shall be installed with a minimum cover of 36 inches.

D. The ENGINEER reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

E. Changes in the grade and horizontal alignment of the pipeline as shown in the DRAWINGS or as provided elsewhere in the SPECIFICATIONS may be necessary due to unanticipated interferences or other reasons.

1. No additional compensation will be allowed the CONTRACTOR for changes in horizontal alignment.

2. No additional compensation will be allowed for changes in grade which require additional depth of trench excavation and backfill up to 2 feet from those shown in the DRAWINGS.

F. Use laser-beam instrument with qualified operator to establish lines and grades.

3.5 OBSTRUCTIONS

A. Obstructions to the construction of the trench, such as tree roots, stumps, abandoned pilings, abandoned buildings and concrete structures, logs, rubbish, and debris of all types shall be removed without additional compensation from the OWNER.

B. The ENGINEER may, if requested by the CONTRACTOR or OWNER, make changes in the trench alignment to avoid major obstructions if such alignment changes can be made within the perpetual easement and right-of-way and without adversely affecting the intended function of the facility or increasing costs to the OWNER.

3.6 INTERFERING ROADWAYS AND STRUCTURES

A. Remove, replace and/or repair any damage done during trenching activities to fences, buildings, cultivated fields, drainage crossings, and any other properties without additional compensation from the OWNER.

1. Replace or repair these structures to a condition as good as or better than their pre-construction condition prior to commencing WORK in the area.

B. Paved Roadways:

1. Where paved roadways are cut as part of trenching activities, Class D trench backfill will be required to the bottom of pavement base.

2. New pavement shall be equal to or better than the existing paved surface.

3. New surface shall not deviate by more than 1/4-inch from the existing finish elevation.

C. Existing Structures:

1. If existing structures are encountered as part of trenching activities which will prevent construction and are not adequately shown in the DRAWINGS, the CONTRACTOR shall notify the ENGINEER before continuing with the WORK.

2. The ENGINEER may make such field revisions to the utility alignment as necessary to avoid conflict with the existing conditions.

3. The cost of waiting or "down time" during such field revisions shall be borne by the CONTRACTOR without additional cost to the OWNER or liability to the ENGINEER.

4. If the Contactor fails to so notify the ENGINEER when a conflict of this nature is encountered, but proceeds with construction despite this interference, the CONTRACTOR shall do so at the CONTRACTOR's own risk with no additional payment.

3.7 TRENCHING

A. Excavate subsoil as required for construction of utilities to elevations shown in the DRAWINGS.

B. Remove boulders and rock up to 1/2 cubic yard measured by volume per the requirements of this Section. Remove larger boulders and rock material as specified in Section 31 23 18, Rock Removal.

C. Open Trench Limit:

1. Do not advance open trench beyond the distance which will be backfilled and compacted the same day.

2. A maximum length of open trench shall not exceed 100 feet at any one time.

3. Temporary resurfacing shall be completed within 300 feet of the associated open trench limit for each main pipe laying operation.

4. Cover or backfill excavations at the end of each day.

5. If the trench is not backfilled at the end of each working day:

a. Provide means to prevent caving of excavation sides, as necessary, during non-working hours.

b. Cover the excavation with a system as needed to provide public safety and prevention of entry during non-working hours.

c. Provide signed and stamped submittal of caving prevention system and cover system.

6. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

D. Utility Crossings: Avoid horizontal and vertical conflicts with existing utilities.

1. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.

2. Vertical clearance between the new pipe and existing utilities shall be 12 inches minimum, unless otherwise noted on the DRAWINGS.

3. Where existing utility lines are damaged or broken during trenching activities, the utility shall be repaired or replaced. For water or sewer bearing lines, care being taken to insure a smooth flow line and absolutely no leakage at the new joints.

4. All expenses involved in the repair or replacement of leaking or broken utility lines that have occurred due to the CONTRACTOR's operations shall be borne by the CONTRACTOR, and the amount thereof shall be absorbed in the unit prices of its bid.

E. Water Lines Crossing Sewer Lines: Whenever water lines cross sewer lines, the CONTRACTOR shall comply with local Health Department requirements.

1. Wherever possible, the bottom of the water line shall be 18 inches or more above the top of sewer pipe. One full length of the water line pipe shall be centered at the crossing.

2. For clearances less than 1-1/2 feet, the CONTRACTOR shall replace the existing sewer pipe with ductile iron or PVC of equal size, centered at the utility crossing, or shall encase existing sewer pipe with concrete for a minimum of 10 feet on both sides of crossing, as directed by the ENGINEER, at no additional cost to the OWNER.

F. Excavate trenches to width and depth as indicated on DRAWINGS. No additional payment will be provided for trenching activities beyond dimensions shown in the DRAWINGS.

1. Excavation for trenches in which pipelines are to be installed shall provide adequate space for workers to place and joint the pipe properly and safely, but in every case the trench shall be kept to a minimum width.

2. The width of the pipe trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench shall not exceed 12 inches on either side of the pipe.

3. Excavation for utility vaults and other structures shall be wide enough to provide 18 inches between the structure surface and the sides of the excavation.

4. For pipe or utility vaults to have bedding material, excavate to a depth of 6 inches below the bottom of the pipe or utility vault. Care shall be taken not to excavate below depths required.

5. If over digging occurs, the trench bottom shall be filled to grade with compacted bedding material.

G. Remove water or materials that interfere with WORK.

1. The trench at all times shall be kept free from water to facilitate fine grading, the proper laying and joining of pipe, and prevention of damage to completed joints.

2. Adequate pumping equipment shall be provided to handle and dispose of the water without damage to adjacent property.

3. Water in the trench shall not be allowed to flow through the pipe while construction work is in progress unless special permission to do so has been given by the ENGINEER.

4. An adequate screen shall be provided to prevent the entrance of objectionable material into the pipe.

5. Remove and dispose of existing abandoned sewer pipe, structures, and other facilities as necessary to construct the improvements.

    a. Where the excavation activities require the removal of portions of an abandoned pipeline, masonry plugs shall be installed in the open ends of the pipe, unless otherwise noted in the DRAWINGS or by the ENGINEER.

    b. Coordinate with ENGINEER prior to plugging.

    c. For plugs less than 36 inches in diameter, 8-inch deep masonry units shall be used. For plugs in larger pipelines, 12-inch deep masonry units shall be used.

6. The costs associated with the removal of water and materials noted above will be considered incidental to trench excavation and backfill.

H. Do not interfere with 45 degree bearing splay of foundations.

I. Over-excavation for Unsuitable Trench Foundation Conditions:

1. Cross-sectional dimensions and depths of excavations shown in the DRAWINGS shall be subject to such changes as may be found necessary by the ENGINEER to secure foundations free from soft, weathered, shattered, and loose material or other objectionable materials.

2. Unsuitable materials shall be removed and replaced only as directed in writing by ENGINEER.

3. Unsuitable materials encountered shall be removed and replaced with Coarse Aggregate Type A1, 2-1/2-inch – 0 gradation, as specified in Table 31 05 16-A of Section 31 05 16, Aggregates for Earthwork. All material placed shall be compacted to 95 percent of maximum dry density.

4. Install nonwoven geotextile under trench stabilization material, over the soft or yielding excavated surface.

    a. Install the nonwoven geotextile ahead of placement of the trench stabilization material, continuously along the excavation bottom and centered on the pipe centerline.

b. Use nonwoven geotextile width equal to the pipe diameter plus 2 feet.

c. Place laps or splices in the geotextile in the direction of the pipe laying.

J. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

K. Excavated material shall be placed at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic or interfere with the function of existing drainage facilities or system operation.

L. Remove excess subsoil not intended for reuse from site.

M. Stockpile excavated material in area designated on site in accordance with Section 31 05 13, Soils for Earthwork.

3.8 TUNNELING

A. In lieu of open cut trenching as specified above, the CONTRACTOR may utilize tunnel methods for installation of pipe where ground conditions are favorable and such methods will not disturb foundations under curbs, sidewalks and other structures.

1. The ENGINEER must approve tunneling methods prior to utility installation.

2. Where tunneling is used, payment for the pipe installation will be made for the equivalent trench excavation and backfill as if the open cut method was used. Payment will not be made for surface restoration including pavement, curbs, sidewalks, and other surface improvements whose replacement is avoided by the tunneling method.

3.9 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, new and existing structures, and adjacent and neighboring properties and to prevent caving, erosion, settlement, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

D. Repair damage to new and existing WORK from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

E. Design sheeting and shoring to be removed at completion of excavation WORK, unless shown otherwise in the DRAWINGS.

F. Construction Sheeting Left in Place:

1. Furnish, install, and leave in place construction sheeting and bracing when specified or when indicated or shown on the DRAWINGS.

2. Construction sheeting and bracing originally intended for temporary installation, placed by the CONTRACTOR to protect adjacent and neighboring structures, may be left in place if desired by the CONTRACTOR and approved by the ENGINEER. All such sheeting and bracing left in place shall be included in the cost for excavation.

3. Any construction sheeting and bracing which the CONTRACTOR has placed to facilitate its WORK may be ordered in writing by the ENGINEER to be left in place. The right of the ENGINEER to order sheeting and bracing left in place shall not be construed as creating an obligation on its part to issue such orders. Failure of the ENGINEER to order sheeting and bracing left in place shall not relieve the CONTRACTOR of its responsibility under the contract.

4. For sheeting and shoring to be left in place as part of the completed WORK, cut off minimum 18 inches below finished grade.

3.10 COMPACTION

A. Testing will be required to show specified densities of compacted backfill are being achieved by the CONTRACTOR's compaction methods.

B. Moisture Control:

1. Moisture condition backfill material to within 2 percent of optimum moisture content required for compaction throughout each lift of the fill.

2. Add moisture to granular backfill by sprinkling during compaction operation.

3. Compaction by ponding or jetting is not permitted.

C. Compact all materials and areas that are not accessible for in-place density testing, as determined by the ENGINEER, in place by whatever equipment and method is practicable or specified, and as approved by the ENGINEER.

1. Perform compaction at such moisture content as is required to produce well-filled, dense, and firm material in place that will show no appreciable deflection or reaction under the compacting equipment.

3.11 BEDDING

A. All utility vaults, potable water pipe 4-inch nominal diameter and over, all steel pipe, all concrete sewer pipe, all plastic pipe, all pipe under existing or future structures or roadways, and any and all utilities at a depth greater than 6 feet shall be laid in pipe bedding material.

B. Unless otherwise noted in the DRAWINGS, pipe or conduit of less than 4-inch diameter, outside structure lines and at a depth of less than 6 feet shall be bedded in native material properly shaped as specified below, all as detailed on the DRAWINGS.

C. Compacted bedding material shall be placed the full width of the excavated trench to a depth as shown on the trench detail included in the DRAWINGS.

1. In lieu of a detail, the depth shall be 6 inches.

D. Spread the bedding smoothly over entire width of trench to the proper grade so that the pipe is uniformly supported along the barrel.

E. Hand grade and compact each lift to provide a firm, unyielding surface along the entire pipe length. For rigid pipe, compact to at least 90 percent relative compaction.

F. Excavate bell holes at each joint to permit proper assembly and inspection of the joint.

G. Check grade and correct irregularities in bedding material.

H. Center pipes horizontally in trench width.

3.12 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Place fill material, with the exception of CLSM, in continuous layers and compact in 6- to 8-inch lifts.

1. Prevent pipe from moving either horizontally or vertically during placement and compaction of pipe zone material.

2. Where trenches are under existing or future structures, paved areas, road shoulders, driveways or sidewalks, or where designated on the DRAWINGS or specified elsewhere in these SPECIFICATIONS, the trench backfill shall be Class B or Class E and pipe zone backfill shall be Class B or Class E. Class B backfill shall be compacted to 95 percent of maximum density at optimum moisture content.

3. Where trenches are outside existing or future structures, paved areas, road shoulders, driveways or sidewalks, or where designated on plans or specified elsewhere, the trench backfill shall be Class A and pipe zone backfill in these areas shall be Class B. For these locations, compaction of Class B backfill shall be to not less than 90 percent of maximum density at optimum moisture content. Class B backfill shall be compacted to not less than 95 percent of maximum density at optimum moisture content.

E. Employ placement method that does not disturb or damage nearby or adjacent foundation perimeter drainage or utilities in trench.

F. Do not use power-driven impact compactors to compact pipe zone material.

G. Backfill Immediately: All trenches and excavations shall be backfilled immediately after pipe or conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible, unless otherwise directed by the ENGINEER.

H. Under no circumstances shall water be permitted to rise in open trenches after pipe has been placed.

I. Do not allow backfill material to free fall into the trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over the top of pipe.

J. Use hand compactors for compaction until at least 2 feet of backfill is placed over top of pipe. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by "walking in" and slicing material under haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.

K. Placement of Sand:

1. Place medium sand in lifts not exceeding 8 inches in uncompacted thickness.

2. Compact each lift to a minimum of 95 percent relative compaction prior to placing succeeding lifts.

L. Placement of CLSM:

1. Discharge from truck-mounted drum-type mixer into trench.

2. Place in lifts not exceeding 2 feet in thickness.

3. No compaction of CLSM is allowed.

4. Use steel plates to protect the CLSM from traffic a minimum of 24 hours. After 24 hours, the CLSM may be paved, or opened to traffic until permanent surface restoration is completed, if it has hardened sufficiently to prevent rutting.

M. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

N. Do not leave trench open at end of working day.

3.13 MARKING TAPE INSTALLATION

A. Continuously install marking tape along centerline of all buried piping, install 24 inches below finished grade. Coordinate with piping installation DRAWINGS.

3.14 ELECTRONIC LOCATING FACILITY INSTALLATION

A. Marker Balls:

1. Install according to manufacturer's recommendations and as shown or directed and according to the following requirements:

a. Install marker balls directly above the pipe alignment at a depth no less than 3 feet and no more than 4-1/2 feet below final surface grade.

b. Install marker balls during trench backfill operations by placing the marker ball in compacted backfill.

c. Cover marker ball with a minimum of 6 inches of backfill and compact backfill before continuing trench backfill operations.

d. Install markers balls with trenchless pipe installations by core-drilling hole of a minimal diameter needed to allow clearance for placement of marker ball. Backfill with approved trench backfill, pavement base and pavement, as applicable.

2. Water Marker Ball Locations: Install at locations as required by Sewer Marker Ball Locations specified herein.

3. Sewer Marker Ball Locations:

a. Install marker balls directly above connection points, termination points and all fitting locations, and at a minimum spacing of 50 linear feet on sewers with a straight horizontal alignment.

b. Install marker balls at a minimum spacing of 25 lineal feet directly above sewer mains installed on a radius.

c. Install marker balls on new or reconstructed sewer service laterals, directly above the centerline of the end of the lateral at the curb, property line or other end of lateral location, as directed.

d. Install marker balls directly above every alignment change along sewer mains and service laterals.

e. Install marker balls directly above manholes for manholes with buried covers.

B. Tracer Wire and Terminal Appurtenances:

1. Tracer Wire:

a. Install as shown or directed directly over the pipe centerline and on top of the pipe zone in all sewer trenches, including mainline sewers, service laterals and storm sewer inlet leads.

b. Connect mainline and service lateral tracer wires using either an approved direct-bury lug connector or direct-bury twist connector.

c. Extend tracer wire to locator stations in manholes, locator boxes, storm inlets, or other visually identifiable terminal appurtenances, allowing for access with electronic locating equipment, as shown or directed and according to the following requirements:

2. Locator Stations:

a. Install locator stations as shown within manholes.

b. Mount locator station to manhole wall within 18 inches of manhole rim with two stainless steel expansion anchors.

c. Drill a minimum 3/8-inch diameter hole through the manhole wall within 18 inches of the finish grade of the manhole rim.

d. Extend the tracer wire from the pipe trench in one continuous piece up the outside of the manhole and through the hole and into a locator station and attach to one of the lugs in the locator station.

e. When multiple tracer wires are terminated in manhole install a multi-lead locator station.

f. Extend a ground wire from the locator station through a minimum 3/8-inch diameter hole in the manhole wall.

g. Install ground wire approximately 3 feet deep and extend from the outside manhole wall a minimum of 3 feet horizontally in any direction.

h. Seal all holes drilled in manhole walls with silicone sealant.

3. Storm Inlet Tracer Wire Termination: Terminate tracer wire inside inlet and directly over storm outlet pipe by placing tracer wire as follows:

a. Drill a minimum 3/8-inch diameter hole through inlet wall to pass tracer wire through to inside inlet wall.

b. Seal hole with silicon sealer or material approved by ENGINEER.

c. Leave 6 inches of coiled tracer wire along inside of inlet wall approximately 3 inches below the inlet frame and grate or as directed by ENGINEER.

4. Service Lateral Tracer Wire Termination: Terminate tracer wire at ends of service laterals as shown or directed, as follows:

a. Termination in Tracer Wire Locate Boxes: Extend the tracer wire in one continuous piece up vertically from the pipe trench and into the bottom of the locate box. Leave 18 inches of coiled tracer wire inside locate box.

b. Termination at 2-inch by 4-inch Markers: Extend tracer wire in one continuous piece directly up service lateral 2-inch by 4-inch markers and leave 18 inches of tracer wire wrapped around the exposed top end of 2-inch by 4-inch marker.

3.15 VISUAL IDENTIFICATION FACILITIES

A. Tracer Wire Locate Boxes: Install tracer wire locate boxes directly over service laterals at property line, service boundary, or other location as shown or directed by the ENGINEER.

B. Service Lateral Plastic or Copper Markers:

1. Install plastic or copper markers in the concrete curb directly over the centerline of the service lateral, as shown or directed by the ENGINEER.

2. Either plastic or copper markers may be used.

3. If there is not suitable concrete curb for marker placement, then install a lateral cleanout as close to property line as practical at location approved by ENGINEER.

C. Service Lateral 2-inch by 4-inch Markers:

1. Place a 2-inch by 4-inch marker at the end of each new service lateral not connected to a building sewer.

2. Omit markers only as approved.

3. Block the capped or plugged service lateral end with a wood block against undisturbed earth and install the marker.

4. Extend the marker from the blocked service lateral invert to at least 12 inches above the existing or proposed finish ground surface.

5. Install marker in one piece. No splicing will be accepted.

6. Paint the exposed portion of the marker after its installation with quality quick drying enamel white paint for a storm only sewer and green paint for a sanitary or combined sewer.

7. After the paint has dried, use black, quick drying enamel, and neatly indicate the distance from the ground surface to the top of the service lateral in feet and inches.

8. Do not disturb the position and location of the marker during the backfilling operation.

9. If the marker is broken, moved out of location, or vertical alignment is changed during the backfilling operation, reopen the trench and replace the marker.

3.16 FIELD QUALITY CONTROL

A. All testing and reporting shall be conducted and completed by an independent laboratory with payment responsibility for initial testing as identified in Specification 01 45 00-Quality Control. Subsequent testing after failure of initial acceptance testing shall be paid by the CONTRACTOR.

B. Perform laboratory material tests in accordance with ASTM D1557 (AASHTO T180).

C. In-place compaction testing of pipeline backfill materials shall be performed at 2-foot elevation increments, one test per 200 lineal feet of pipeline trench as measured along pipe centerline.

1. The ENGINEER may reduce the frequency when satisfied with method of compaction.

2. The ENGINEER may direct testing at a higher frequency at no additional cost to the OWNER upon failure to obtain specified densities or if the CONTRACTOR changes compaction equipment or methods of compaction.

3. The ENGINEER shall determine all test locations.

D. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922
2. Moisture Tests: ASTM D3017

E. When tests indicate WORK does not meet specified requirements, remove WORK, replace and retest at the sole expense of the CONTRACTOR.

3.17 SURFACE RESTORATION AND CLEANUP

A. Open Trenches: At the end of each workday, all open trenches shall be backfilled and all trenches within streets shall be temporarily paved or covered to the satisfaction of the ENGINEER and the local permitting agency.

1. Temporary paving shall be replaced with permanent street paving at the completion of construction within street rights-of-way, or sooner, if deemed necessary by the ENGINEER.

2. No gravel-filled trenches shall be left open within the street right-of-way at the end of the workday.

B. Topsoil:

1. Where trenches cross lawns, garden areas, pastures, cultivated fields, or other areas on which reasonable topsoil conditions exist, remove the topsoil to the specified depth and place the material in a stockpile.

2. Topsoil shall not be mixed with other excavated material.

3. After the trench has been backfilled, the topsoil shall be replaced.

C. Clean up and remove all excess materials, construction materials, debris from construction, etc. Replace or repair any fences, mailboxes, signs, landscaping, or other facilities removed or damaged during construction. Replace all lawns, topsoil, shrubbery, flowers, etc., damaged or removed during construction. The CONTRACTOR shall be responsible for seeing that lawns, shrubs, etc. remain alive and leave premises in condition equal to original condition before construction.

END OF SECTION

SECTION 31 23 23 - FILL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes backfilling required at building perimeter and site structures to subgrade elevations, fill under interior and exterior slabs-on-grade or pavement, and fill under landscaped areas. Backfilling for utilities within building proper is included within this section; backfilling for utilities outside building is included in Section 31 23 17, Trenching.

B. Section includes:

1. Backfilling building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs-on-grade.
4. Fill under paving.
5. Fill for over-excavation.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-in-Place Concrete Work
B. Section 31 05 13 - Soils for Earthwork
C. Section 31 05 16 - Aggregates for Earthwork
D. Section 31 23 16 - Excavation
E. Section 31 23 17 - Trenching
F. Section 31 23 24 - Flowable Fill
G. Section 31 25 00 - Erosion and Sediment Controls.
H. Section 33 31 10 - Sanitary Utility Sewerage Piping

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International (ASTM):

1. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

6. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

1.4 DEFINITIONS

A. Controlled Low Strength Material (CLSM): Also referred to as Flowable Fill elsewhere in these SPECIFICATIONS. A self-compacted, cementitious material.

B. Imported Material: Materials obtained from sources offsite, suitable for specified use.

C. Lift: Loose (uncompacted) layer of material.

D. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Imported Materials:

1. Materials Source: Submit name and location of imported fill materials suppliers.
2. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
3. Submit results of aggregate sieve analysis and standard proctor test for granular material.

C. CLSM: Mix designs in accordance with Submittal requirements of Section 31 23 24, Flowable Fill.

1.6 QUALITY ASSURANCE

A. Subsoil and topsoil fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 13, Soils for Earthwork.

B. Aggregate fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 16, Aggregates for Earthwork.

C. CLSM:

1. In-place testing: In accordance with ASTM C403.
2. Compressive testing: In accordance with ASTM D4832.

D. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S2, Imported Fill Material, as specified in Section 31 05 13, Soils for Earthwork.

B. Structural Fill and Backfill: Coarse Aggregate Type A1, Dense-Graded Aggregate with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

C. Concrete:

1. Lean concrete as specified in Section 31 23 24, Flowable Fill, with compressive strength of 100 pounds per square inch (psi).

2. Structural concrete as specified in Section 03 30 00, Cast-in-Place Concrete Work. Compressive strength as required by the application or as noted in the Drawings.

D. Drain Rock: Coarse Aggregate Type A2, Granular Drain Backfill Material with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

E. Foundation Stabilization Material: Coarse Aggregate Type A1, Dense-Graded Aggregate, 2-1/2-inch - 0 gradation as specified in Section 31 05 16, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to WORK in this Section, become familiar with Site conditions. In the event discrepancies are found, notify ENGINEER as to the nature and extent of the differing conditions.

B. Verify sub-drainage, damp-proofing, or waterproofing installation has been inspected.

C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 SITE CONDITIONS

A. Quantity Survey: The CONTRACTOR shall be responsible for calculations for quantities and volume of cut and fill from existing site grades to finish grades established under this contract as indicated in the DRAWINGS or specified and shall include the cost for all earthwork in the total basic bid.

B. Dust Control: Must meet all federal, state, and local requirements. Protect persons and property from damage and discomfort caused by dust. Water surfaces as necessary and when directed by ENGINEER to quell dust.

C. Soil Control: Soil shall not be permitted to accumulate on surrounding streets or sidewalks nor to be washed into sewers.

D. See provisions for WORK in Section 31 25 00, Erosion and Sediment Controls.

3.3 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Control of Water:

1. Excavated areas shall be kept free of water and frost.

2. Bearing surfaces which become softened by water or frost shall be re-excavated to solid bearing at CONTRACTOR's expense and backfilled with compacted crushed rock at CONTRACTOR's expense.

3. See Section 31 23 19, Dewatering for additional details.

C. Compact subgrade to density requirements for subsequent backfill materials.

D. Cut out soft areas of subgrade not capable of compaction in place and replace with specified granular fill material. See Article 3.5, Over-excavation for Unsuitable Foundation Conditions in Section 31 23 16, Excavation for additional details.

E. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

F. Subgrade to be approved by ENGINEER prior to placement of structures and commencement of backfill activities.

G. Do not allow or cause any work performed or installed to be covered up or enclosed prior to required tests and approvals. Should any WORK be enclosed or covered up, uncover at CONTRACTOR's expense.

3.4 BACKFILLING

A. Backfill areas to contours and elevations shown in the DRAWINGS with unfrozen materials.

B. Do not place materials when weather conditions and/or moisture content prevent attainment of specified density.

C. Maintain optimum moisture content of backfill materials to attain required compaction density.

D. Employ placement method that does not disturb or damage other WORK.

E. Mechanical tampers permitted in confined areas.

F. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

G. Foundation Base for Structures:

1. Bring excavation to required subgrade elevation shown in the DRAWINGS.

2. Place foundation base material to required grade shown in the DRAWINGS.

3. Place foundation base material in 6-inch lifts and compact to 95 percent maximum dry density.

4. Pump Station:

    a. Concrete Footings: Place a 6-inch minimum layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, 3/4-inch-0 gradation to required grade under all concrete footings.

    b. Concrete Slabs: Place an 8-inch minimum layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, 3/4-inch-0 gradation under all concrete slabs.

5. Foundations established near finished site grades:

    a. Place a 3-inch thick layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, 3/4-inch-0 gradation in the bottom of footing excavations to minimize disturbance of silty foundation soils during wet weather.

    b. Lightly compact material with a light-weight hand-operated vibratory plate compactor.

    c. To provide uniform support, slabs should be underlain by a minimum 8-inch thick granular base course consisting of 1-1/2- or 3/4-inch - 0 gradation.

    d. The base course material should be installed in a single lift and compacted to at least 95 percent of the maximum dry density. See DRAWINGS for details.

H. Backfill for Structures:

1. Prior to placing backfill, remove forms, temporary construction, and debris below grade.

2. Backfill shall not be placed against poured concrete until 28 days have passed from completion of original concrete pour, unless otherwise approved by ENGINEER.

3. Heavy compactors and large pieces of construction equipment shall be kept away from any embedded wall a distance of a least 5 feet in order to avoid the build-up of excessive lateral pressures.

    a. Over-compaction of fill near walls should be avoided.

4. Compaction within 5 feet of the walls shall be accomplished using hand-operated vibratory plate compactors or tamping units.

5. The maximum particle size of granular material placed against buried structures shall be limited to no greater than 1-1/2-inch diameter.

6. Structural fill backfill material shall be brought up on all sides of the walls and footings in such a manner as to avoid adverse differential lateral earth pressures on the vertical surfaces.

7. Appropriate lift thickness will depend on the type of compaction equipment used and the type of material being placed. All material shall be compacted to at least 95 percent of the standard maximum dry density.

    a. For moderate- to heavy-weight compactors, a maximum loose lift thickness of 12 inches shall be used.

    b. For hand-operated or small compactors, a maximum loose lift thickness of 8 inches shall be used.

8. Particular care must be taken to avoid damage to the pipe connections to the structure.

9. Utility trench backfill within 10 feet of all structural perimeters shall meet the requirements for structural fill.

I. For areas receiving surface structures or existing paved areas to be constructed or replaced, such as roadways, driveways, parking lots, and sidewalks:

1. Place Coarse Aggregate Type A1, Dense-Graded Aggregate, 3/4-inch-0 gradation in 6-inch lifts.

2. Compact with vibratory equipment to 95 percent maximum density, unless otherwise specified or shown in the DRAWINGS.

J. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet, unless noted otherwise in the DRAWINGS.

K. Make gradual grade changes. Blend slope into level areas.

L. Remove surplus backfill materials from Site in accordance with Section 31 23 16, Excavation.

3.5 FIELD QUALITY CONTROL

A. All testing and reporting shall be conducted and completed by an independent laboratory with payment responsibility for initial testing as identified in Specification 01 45 00-Quality Control. Subsequent testing after failure of initial acceptance testing shall be paid by the CONTRACTOR.

B. Perform laboratory material tests in accordance with ASTM D1557 (AASHTO T180).

C. In-place compaction testing for structural fill material shall be performed at 2-foot elevation increments in the fill material with at a minimum of one test per each 2,500 square feet of material placed. The ENGINEER shall be provided with the results of each compaction test at the time of testing.

D. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922.
2. Moisture Tests: ASTM D3017.

E. When tests indicate WORK does not meet specified requirements, remove WORK, replace and retest at the sole expense of the CONTRACTOR.

F. When testing of subgrade is not possible or feasible as detailed above, proof roll compacted fill surfaces under slabs-on-grade, pavers, paving, and as may be otherwise required by the ENGINEER.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 23 24 - FLOWABLE FILL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes flowable lean concrete mix used for structure backfill, utility bedding and backfill and other subgrade Site Work. Applications also include filling abandoned structures and utilities that remain in place.

B. Section Includes:

1. Structure backfill
2. Utility bedding
3. Utility backfill
4. Filling abandoned utilities

1.2 RELATED SECTIONS

A. Section 33 11 50 - Existing Pipe Abandonment
B. Section 31 23 16 - Excavation
C. Section 31 23 17 - Trenching
D. Section 31 23 23 – Fill
E. Section 33 31 10 - Sanitary Utility Sewerage Piping

1.3 DEFINITIONS

A. Flowable Fill: Also referred to as Controlled Low Strength Material (CLSM) elsewhere in the SPECIFICATIONS. Lean cement concrete fill.

B. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.

1.4 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM C33 - Standard Specification for Concrete Aggregates
2. ASTM C94 - Standard Specification for Ready-Mixed Concrete
3. ASTM C150 - Standard Specification for Portland Cement
4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete
5. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
6. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete
7. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

8. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

9. ASTM C1040 - Standard Test Methods for Density of Unhardened and Hardened Concrete in Place by Nuclear Methods

10. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Field Quality-Control Submittals:

1. Mix Design:

a. Furnish flowable fill mix design for each specified strength.

b. Furnish separate mix designs when admixtures are required for the following:

1) Flowable fill Work during hot and cold weather.
2) Air entrained flowable fill Work.

c. Identify design mix ingredients, proportions, properties, admixtures, and tests.

2. Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements.

D. Delivery Tickets:

1. Furnish duplicate delivery tickets indicating actual materials delivered to Project Site.

1.6 QUALITY ASSURANCE

A. In-place testing of Flowable Fill: In accordance with ASTM C403.
B. Compressive testing of Flowable Fill: In accordance with ASTM D4832.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Minimum Conditions: The following minimum conditions shall be met at time of flowable fill placement.

1. Do not install flowable fill during inclement weather.

2. Ambient temperature must be at least 34 degrees Fahrenheit (F) (4 degrees Celsius (C)) and rising.

3. Flowable fill shall be at 40 degrees F (4 degrees C).

4. Subgrade on which flowable fill is to be placed shall be free of disturbed or soft material, debris and water.

1.8 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 PRODUCTS

2.1 FLOWABLE FILL

A. Flowable Fill:

1. Composed of cement, pozzolans, fine aggregate, water, and admixtures.

2. Low cement content.

3. Non-segregating, self-consolidating, free-flowing, and excavatable material which will result in a hardened, dense, non-settling fill.

4. Compressive strength at 28 days of 100 to 200 pounds per square inch (psi), if not otherwise shown in DRAWINGS or specified.

2.2 MATERIALS

A. Portland Cement: ASTM C150, Type 1 - Normal.
B. Fine Aggregates: ASTM C33.
C. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical Admixture: ASTM C494.

1. Type A - Water Reducing
2. Type B - Retarding
3. Type C - Accelerating
4. Type D - Water Reducing and Retarding
5. Type E - Water Reducing and Accelerating
6. Type F - Water Reducing, High Range
7. Type G - Water Reducing, High Range, and Retarding

C. Fly Ash: ASTM C618 Class C or F, obtained from residue of electric generating plant using ground or powdered coal.

D. Plasticizing: ASTM C1017 Type 1, plasticizing.

2.4 MIXES

A. Mix and deliver flowable fill according to ASTM C94, Option C.

B. Flowable Fill Design Mix:

ITEM	PROPERTIES
Cement Content	75 to 100 lb/cu yd
Fly Ash Content	None
Water Content	As specified
Air Entrainment	5 to 35 percent
28-Day Compressive Strength	Maximum 200 psi.
Unit Mass (Wet)	110 [125] pcf
Temperature, Minimum at Point of Delivery	50 degrees F (10 degrees C)

C. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.

D. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.

2.5 SOURCE QUALITY CONTROL

A. Test and analyze properties of flowable fill design mix and certify results for the following:

1. Design mix proportions by weight of each material.

2. Aggregate: ASTM C33 for material properties and gradation.

3. Properties of plastic flowable fill design mix including:

   a. Temperature
   b. Slump
   c. Air entrainment
   d. Wet unit mass
   e. Yield
   f. Cement factor

4. Properties of hardened flowable fill design mix including:

   a. Compressive strength at 1-day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.

   b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

B. Prepare delivery tickets containing the following information:

1. Project designation
2. Date
3. Time
4. Class and quantity of flowable fill
5. Actual batch proportions
6. Free moisture content of aggregate
7. Quantity of water withheld

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavation specified in Section 31 23 16, Excavation and trenching specified in Section 31 23 17, Trenching is complete.

B. Verify utility installation as specified in elsewhere in the SPECIFICATIONS is complete and tested before placing flowable fill.

C. Verify excavation is dry and dewatering system is operating, as may be required, prior to placement of flowable fill.

3.2 PREPARATION

A. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

C. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

A. Place flowable fill by chute, pumping, or other methods as approved by ENGINEER.

B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

C. Place flowable fill evenly on both sides of utilities to maintain alignment.

D. Place flowable fill to elevations indicated on DRAWINGS without vibration or other means of compaction.

3.4 INSTALLATION - FILLING ABANDONED UTILITIES

A. As specified in Section 33 11 50, Existing Pipe Abandonment.

3.5 FIELD QUALITY CONTROL

A. Perform inspection and testing according to ASTM C94.

1. Take samples for tests for every 100 cubic yards of flowable fill, or fraction thereof, installed each day.

2. Sample, prepare, and test four compressive strength test cylinders according to ASTM D4832. Test one specimen at 3 days, one at 7 days, and two at 28 days.

3. Measure temperature at point of delivery when samples are prepared.

B. Further construction proceeding upon placed flowable fill will be permitted only after initial set is attained, as measured by ASTM C 403.

1. Perform in place penetration (density) tests using handheld penetrometer to measure penetration resistance of hardened flowable fill.

2. Perform tests at locations as directed by ENGINEER.

C. Defective Flowable Fill: The ENGINEER reserves the right to reject all flowable fill failing to meet the following test requirements or flowable fill delivered without the following documentation.

1. Test Requirements:

a. Minimum temperature at point of delivery.
b. Compressive strength requirements for each type of fill.

2. Documentation: Duplicate delivery tickets.

D. No traffic or construction equipment shall be allowed on flowable fill for a least 24 hours after placement.

3.6 CLEANING

A. Remove spilled and excess flowable fill from Project Site.

B. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION

SECTION 31 25 00 – EROSION AND SEDIMENT CONTROLS

PART 1 GENERAL

1.1 SCOPE

A. This section covers the requirements for temporary and permanent erosion and sedimentation control necessary to prevent migration of sediment and silt laden water to adjacent surface water bodies and drainage structures.

B. The CONTRACTOR shall provide all materials, labor, and equipment necessary to install adequate erosion and sedimentation controls.

1.2 QUALITY CONTROL

The OWNER will apply to the Oregon Department of Environmental Quality (DEQ) and obtain a 1200-C Erosion Control Permit. All fees and permit costs will be borne by the OWNER. If CONTRACTOR proposes to modify the approved erosion control plan, the CONTRACTOR shall work with DEQ to revise application/permit. CONTRACTOR shall obtain the final permit and shall be responsible for compliance with all permit provisions and shall accommodate all special inspections required thereof, all at no additional expense to the OWNER beyond prices as bid.

A. In addition to the conditions of the Erosion Control Permits issued by DEQ, erosion control provisions shall conform to regulatory requirements of the following agencies.

1. Federal Clean Water Act – Section 208.
2. Oregon Revised Statutes – Chapter 451.

1.3 SUBMITTALS

A. Following the Preconstruction Conference, the CONTRACTOR shall request City to transfer the name of the permit holder to the CONTRACTOR by submitting a completed 1200-C Name Change and Permit Transfer Application to DEQ. The 1200-C permit will be transferred to CONTRACTOR who will have sole responsibility for compliance with all of the permit requirements and the day-to-day implementation of the Erosion and Sediment Control Plan.

B. Upon completion of and acceptance of all Work, CONTRACTOR shall submit Notice of Termination Application for NPDES General Permit to Discharge Storm Water Associated with Construction Activity to DEQ.

1.4 SCHEDULE

A. Required temporary sedimentation control facilities must be constructed and in operation prior to land clearing and other construction to ensure that sediment laden water does not enter the natural drainage systems.

B. Temporary sediment facilities shall be maintained in a satisfactory condition until such time that permanent ESC facilities are in place or sufficient vegetation has been established and potential for on-site erosion has passed.

C. The implementation, maintenance, replacement, and additions to erosion/sedimentation control systems shall be the responsibility of the CONTRACTOR.

PART 2 PRODUCTS

2.1 CHECK DAM SAND OR GRAVEL BAGS

A. Bags to be either burlap or woven “Geotextile” fabric filled with gravel or sand.

2.2 JUTE MATTING

A. Be of a uniform open plain weave of unbleached, single jute yarn treated with a fire-retardant chemical.

B. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than one-half of its normal diameter.

C. Furnished in rolled strips 48 inches wide by approximately 50 yards long.

D. Average weight of 0.92 pounds per square yard with an allowable tolerance of plus or minus 1 inch in width and 5 percent in weight.

2.3 FILTER FABRIC

A. Filter fabric for the erosion protection barriers shall be Mirafi 140, or equivalent.

2.4 WIRE

A. Wire for the erosion protection barriers shall be 2 by 2 mesh, 12-gauge galvanized wire.

2.5 SUPPORT POSTS

A. Support posts for the erosion protection barriers shall be minimum 2-inch by 2-inch, Douglas Fir No. 1, or better wood posts.

2.6 CLEAR PLASTIC COVERING

A. Clear plastic covering for protection of slopes and cuts shall meet the requirements of the NBS Voluntary Product Standard, PS 17 for Polyethylene sheeting having a minimum thickness of 6 mil.

PART 3 EXECUTION

3.1 EROSION CONTROL

A. Erosion control provisions shall meet or exceed the requirements of the local agency having jurisdiction.

B. When provisions are specified and shown on the DRAWINGS, they are the minimum requirements.

C. CONTRACTOR shall not permit sediment-laden waters to enter natural waterways.

D. As construction progresses and seasonal conditions dictate, more siltation control facilities may be required. It shall be the responsibility of the CONTRACTOR to address new conditions

that may be created and to provide additional facilities over and above minimum requirements as may be required.

E. Provide temporary erosion control measures to prevent erosion from piles of topsoil or fill material. Before completing the Contract, any areas of bare soil shall be permanently seeded.

F. Additional measures may be necessary depending on construction activity and weather. CONTRACTOR will be responsible for carrying out the erosion control provisions of the approved ESC Plan.

1. Keep streets and paved surfaces clean of mud and debris. Install gravel construction entrances as shown on the Plans and maintain them for the duration of the construction period.

3.2 SILTATION CONTROL

A. Siltation control is required. Check dams or silt fences may be placed in streams or ditches receiving stormwater from areas disturbed by construction.

3.3 FILTER FABRIC FENCES

A. Filter fabric fence shall consist of filter fabric fastened to wire fabric with staples or wire rings.

B. Wire shall be fastened to posts set at 6 foot-maximum centers.

C. Fabric shall be buried into ground a minimum of 12 inches to prevent silt from washing under fabric.

D. Fence shall be located to catch silt and prevent discharge to drainage courses.

3.4 EROSION CONTROL CHECK DAM

A. Sand or gravel filled bags shall be installed in drainage way to catch silt.

B. Spillway shall be lower than outer edge of dam. Leave a one sandbag gap in top row to provide spillway.

3.5 PLACING JUTE MATTING

A. Seed and fertilizer shall be placed prior to placing of matting.

B. Jute matting shall be unrolled parallel to the flow of water. Where more than one strip of jute matting is required to cover the given area, it shall overlap the adjacent mat a minimum of 4 inches. The ends of matting shall overlap at least 6 inches with the upgrade section on top.

C. The up-slope end of each strip of matting shall be staked and buried in a 6-inch-deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (one stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench.

D. ENGINEER may require that any other edge exposed to more than normal flow of water or strong prevailing winds be staked and buried in a similar manner.

E. Check-slots shall be laced between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as up-slope ends. Check-slots must be placed so that one check-slot or one end occurs within each 50 feet of slope.

F. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting must be spread evenly and smoothly and in contact with the soil at all points.

G. Matting shall be held in place by approved wire staples, pins, spikes, or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in three rows for each strip of matting, with one row along each edge and one row alternately spaced in the middle. All ends of the matting and check-slots shall be fastened at 6-inch intervals across their width. Length of fastening devices shall be sufficient to securely anchor matting against the soil and driven flush with the finished grade.

3.6 PLACING CLEAR PLASTIC COVERING

A. Clear plastic covering shall be installed on erodible embankment slopes.

B. The clear plastic covering shall be installed immediately after completion of the application of roadside seeding. It is the intent of this specification that clear plastic covering will be in place before the fall rainfall begins.

C. Maintain the cover tightly in place by using sandbags or ties on slopes with a minimum of 10-foot grid spacing in all directions. All seams shall be taped or weighted down full length. There shall be at least a 12-inch overlap of all seams.

D. Immediately repair all damaged areas.

3.7 EXISTING DRAINAGE FACILITIES

A. Should a storm sewer or culvert become blocked or have its capacity restricted due to siltation from CONTRACTOR's operations, the CONTRACTOR shall make arrangements with the jurisdictional agency for the cleaning of the facility at no additional expense to the OWNER.

B. CONTRACTOR shall install catch basin inserts in existing catch basins in the vicinity of, or adjacent to, clearing or construction activities to prevent sediment from entering the on-site stormwater conveyance system.

3.8 DRAINAGE DIVERSION

A. CONTRACTOR may divert up-gradient surface runoff water around the site as required. CONTRACTOR will be responsible for routing diverted surface water to its original flow path downstream of the site and providing energy dissipation and/or dispersion as needed to mimic pre-diverted flow characteristics, as required by the ENGINEER.

B. Drainage shall be restored to condition existing prior to construction unless otherwise shown on the DRAWINGS.

END OF SECTION

SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes construction of an aggregate subbase and base course for placement under asphalt or concrete paving, unit paving, or placed and left exposed.

B. Section Includes:

1. Aggregate subbase
2. Aggregate base course

1.2 RELATED REQUIREMENTS:

A. Section 31 22 13 - Rough Grading
B. Section 31 23 17 - Trenching
C. Section 31 05 16 - Aggregates for Earthwork
D. Section 32 12 16 - Asphalt Concrete Pavement

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications

2. T11, Standard Method of Test for Materials Finer Than 75μm (No. 200) Sieve in Mineral Aggregates by Washing

3. T27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates

4. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. ASTM International (ASTM):

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

5. ASTM D2940 - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports

6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.4 DEFINITIONS

A. Completed Course: Compacted, unyielding, free from irregularities and standing water, with smooth, tight, even surface, true to grade, line, and cross-section.

B. Completed Lift: Compacted with uniform cross-section thickness.

C. Keystone: Fine aggregate used to aid in binding of loose surface stone.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit data for geotextile fabric and herbicide.

C. Materials Source: Submit name of aggregate materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

PART 2 PRODUCTS

2.1 SHOULDER AGGREGATE

A. Of the size shown on the Plans.

B. Coarse Aggregate: Type A1, Dense-Graded Aggregate as specified in Section 32 05 16, Aggregates for Earthwork.

2.2 DENSE-GRADED BASE AGGREGATES

A. Of the size shown on the Plans.

B. Coarse Aggregate: Type A1, Dense-Graded Aggregate as specified in Section 32 05 16, Aggregates for Earthwork.

2.3 OPEN-GRADED BASE AGGREGATES

A. Of the size shown on the Plans.

B. Coarse Aggregate: Type A2, Granular Drain Backfill Material as specified in Section 32 05 16, Aggregates for Earthwork.

2.4 SOURCE QUALITY CONTROL

A. Perform tests necessary to locate acceptable source of materials meeting specified requirements.

B. Final approval of aggregate material will be based on test results of installed materials.

C. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

2.5 EQUIPMENT

A. Compaction Equipment: Adequate in design and number to provide compaction and to obtain specified density for each layer.

2.6 ACCESSORIES

A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

A. Obtain Engineer's acceptance of subgrade before placing base course or surfacing material.

B. Verify compacted substrate is dry and ready to support paving and imposed loads.

1. Proof roll substrate with equipment approved by the Engineer in minimum two perpendicular passes to identify soft spots.

2. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place base course or surfacing materials in snow or on soft, muddy, or frozen subgrade.

3.3 HAULING AND SPREADING

A. Hauling Materials:

1. Do not haul over surfacing in process of construction.

2. Loads: Of uniform capacity.

3. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.

B. Spreading Materials:

1. Distribute material to provide required density, depth, grade, and dimensions with allowance for subsequent lifts.

2. Produce even distribution of material on prepared surface without segregation.

3. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.

4. Maintain consistent gradation of material. Widely varying gradation will be cause for rejection.

3.4 CONSTRUCTION OF COURSES

A. Untreated Aggregate Base Course:

1. If the required compacted depth of the base course exceeds 6 inches, construct it in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.

2. Completed Course Total Thickness: As shown on the Plans, 8-inch minimum.

3. Spread lift on preceding course to required cross-section. Place each layer in spreads as wide as practical and to the full width of the course before a succeeding layer is placed.

4. Lightly blade and roll surface until thoroughly compacted.

5. Add keystone to achieve compaction and as required when aggregate does not compact readily due to lack of fines or natural cementing properties, as follows:

a. Use 3/4-inch leveling course or surfacing material as keystone.

b. Spread evenly on top of base course, using spreader boxes or chip spreaders.

c. Roll surface until keystone is worked into interstices of base course without excessive displacement.

d. Continue operation until course has become thoroughly keyed, compacted, and will not creep or move under roller.

6. Blade or broom surface to maintain true line, grade, and cross-section.

B. Gravel Surfacing and Leveling Course:

1. Place shoulder aggregates in a single layer, or two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 9 inches.

2. Spread on preceding course in accordance with cross-section shown.

3. Blade lightly and roll surface until material is thoroughly compacted.

4. Complete Total Thickness: As shown on the Plans, 8-inch minimum.

3.5 ROLLING AND COMPACTION

A. Commence compaction of each layer of base immediately after spreading operations and continue until density of 95 percent of maximum density has been achieved as determined by AASHTO T99.

B. Roll each layer of material until there is no appreciable reaction or yielding under the compactor before succeeding layer is applied.

C. Shape and maintain the surface of each layer during compaction operations. Commence rolling at outer edges and continue toward center; do not roll center of road first.

D. Apply water as needed to obtain specified densities.

E. Place and compact each lift to the required density before succeeding lift is placed.

F. Surface Defects: Remedy by loosening and rerolling. Reroll entire area, including surrounding surface, until thoroughly compacted.

G. Finished surface shall be true to grade and crown before proceeding with surfacing.

3.6 SURFACE TOLERANCES

A. Blade or otherwise work surfacing as necessary to maintain grade and cross-section at all times, and to keep surface smooth and thoroughly compacted.

B. Finished Surface of Untreated Aggregate: Within plus or minus 0.04-foot of grade shown at any individual point.

C. Overall Average: Within plus or minus 0.04-foot from crown and grade specified.

3.7 FIELD QUALITY CONTROL

A. Quality control testing shall be performed by an independent testing laboratory provided by the Owner.

B. Refer to table below for minimum sampling and testing requirements for aggregate base course and surfacing. The OWNER reserves the right to complete additional testing.

Property	Test Method	Frequency	Sampling Point
Gradation	AASHTO T11 and AASHTO T27	One sample every 500 tons but at least every 4 hours of production	Roadbed after processing
Moisture Density (Maximum Density)	AASHTO T99	One test for every aggregate grading produced	Production output or stockpile
In-Place Density and Moisture Content	AASHTO T310	One for each 500 ton but at least every 10,000 square feet of area	In-place completed, compacted area

3.8 CLEANING

A. Remove excess material from the Work area. Clean stockpile and staging areas of all excess aggregate. Restore per Specifications as applicable.

END OF SECTION

SECTION 32 12 16 - ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SCOPE

This section includes the construction of asphalt concrete pavement.

1.2 REFERENCE STANDARDS

A. References herein to "AASHTO" shall mean Association of American State Highway Transportation Officials.

B. Standard Specifications: Where the term "Standard Specifications" is used, such reference shall mean the current edition of the Oregon Department of Transportation (ODOT) Standard Specifications for Highway Construction. Where reference is made to a specific part of the Standard Specifications, such applicable part shall be considered as part of this section of the Specifications. In case of a conflict in the requirements of the Standard Specifications and the requirements stated herein, the requirements herein shall prevail.

1.3 DEFINITIONS

A. Maximum Density Test (MDT): Theoretical maximum density of the bituminous mixture determined by multiplying the theoretical maximum specific gravity, determined by ASTM D2041 (Rice), by 62.4 pounds per cubic foot.

1.4 SUBMITTALS

A. Aggregate Qualification Tests: In accordance with Standard Specifications Section 00640 for aggregate used in aggregate base.

B. Aggregate Qualification Tests: In accordance with Standard Specifications Section 00745 for aggregate used in asphalt concrete.

C. Job mix formula shall be an approved job mix formula. Submit formula, supplier, and product identification to the Engineer 30 days prior to start.

1. Definite percentage for:

    a. Each sieve fraction.
    b. New asphalt cement.
    c. Recycled asphalt pavement.

2. Temperature of completed mix when discharged from mixer.

3. Character and quantity of anti-strip and recycling agents.

1.5 QUALITY ASSURANCE

A. All testing to determine compliance with the specifications shall be performed by an independent testing laboratory contracted by the Contractor and approved by the Engineer. All testing costs shall be borne by the Contractor.

B. A minimum of five nuclear densometer readings shall be taken in random locations within every test area. Each test area shall not exceed 200 tons of asphalt; however, smaller areas may be designated by the Engineer.

C. The surface smoothness of the new asphalt concrete pavement shall be such that when a 10-foot straightedge is laid longitudinally across the paved area in any direction, the new pavement shall not deviate from the straightedge more than 1/8-inch. Surface drainage shall be maintained. Additionally, paving must conform to the design grade and crown and contain no abrupt edges, low or high areas or any other imperfections as determined by the Engineer. Pavement construction not meeting these requirements will be repaired by grinding the existing pavement to a 1-1/2-inch depth and replacing with Level 3, 1/2-inch dense graded Asphaltic Concrete the full width at no cost to Owner.

1.6 PRE-PAVING CONFERENCE

A. Any supervisory personnel of the Contractor and any subcontractors who are to be involved in the paving work shall meet with the Engineer, at a time mutually agreed upon, to discuss methods of accomplishing all phases of the paving work.

B. The Contractor shall be prepared to review the size and type of equipment to be used and the anticipated rate of placement to determine equipment needs.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIAL

A. Aggregate Base for Dense Graded Asphalt Concrete: The aggregate material shall be a clean, well-graded crushed base aggregate conforming to the Standard Specifications. Base course shall be 1-1/2-inch minus aggregate and leveling course shall be 3/4-inch minus aggregate, unless otherwise shown on the plans.

2.2 ASPHALT CONCRETE PAVEMENT

A. Dense Graded Hot Mix Asphalt Concrete

1. Use Level 3, 1/2-inch-dense graded, PG 70-22 HMAC. Conform to the requirements as specified in Section 00745 of the Standard Specifications. Conform to the requirements as specified in Section 00745 of the Standard Specification.

2. Asphaltic concrete pavement delivered to the site shall be accompanied by a ticket with the approved "job mix formula" number shown. Loads without tickets identifying the job mix formula will not be accepted.

3. Percent of recycled asphalt pavement used in new asphalt pavement shall not exceed 30 percent. Recycled asphalt pavement may not be used in top wearing course unless otherwise approved by the Engineer.

B. Tack Coat

In accordance with Standard Specifications. Use AR 4000, AC-20 asphalt or CSS-1 emulsified asphalt C.

C. Seal and Cover Coat

Asphalt material shall be CRS-2 cationic emulsified asphalt. Cover stone shall conform to size 1/4-inch #10 aggregate in the Standard Specifications.

D. Subgrade Geotextile

1. Dense Graded AC Mix-For subgrade separation using dense graded asphalt concrete, use subgrade geotextile with Certification Level B as specified in Section 02320 of the Standard Specifications.

E. Subgrade Stabilization

In the event that unstable materials are encountered during excavation, the additional excavation and installation of geotextile fabric and 12 inches of rock substructure will be required, as directed. Conform to the requirements as specified in Section 00331 of the Standard Specifications. For subgrade separation, use subgrade geotextile with Certification Level B as specified in Section 02320 of the Standard Specifications.

2.3 WHEEL STOPS

A. Provide 6” wide by 6’ long precast concrete wheel stop.

1. Wheel stop concrete to have a minimum 28-day compressive strength of 4,000 psi.
2. Wheel stop to be designed for H20 loading non-roadway applications.
3. Install per manufacturer’s requirements.
4. Manufactured by Oldcastle Infrastructure or approved equal.

PART 3 EXECUTION

3.1 AGGREGATE PAVEMENT BASE

A. Place pavement base to the depth shown on the plans or as specified in all cases, pavement base shall be compacted to a minimum depth of 6 inches. Bring the top of the pavement base to a smooth, even grade at a distance below finished grade equivalent to the required pavement depth.

B. Compact the pavement base with mechanical vibratory or impact tampers to a density of not less than 95 percent of the maximum density, as determined by AASHTO T-99.

C. Obtain the Engineer’s acceptance of the subgrade before beginning construction of the aggregate base course.

D. When, in the judgment of the Engineer, the weather is such that satisfactory results cannot be secured, suspend operations. Place no aggregate base course in snow or in soft, muddy, or frozen subgrade.

E. If the required compacted depth of aggregate base course exceeds 6 inches, construct in two or more lifts of approximately equal thickness. Maximum compacted thickness of any one lift shall not exceed 6 inches. Compact each layer to the specified density before a succeeding lift is placed.

3.2 ASPHALT CONCRETE PAVEMENT

A. Construct asphalt concrete pavement in accordance with Section 00745 of the Standard Specifications.

B. Conform to the requirements for prime coat and tack coat in the Standard Specifications. Tack coat all edges of existing pavement, manhole and clean out frames, inlet boxes, and like items. When rate is not specified, asphalt will be applied at the rate of 0.1-gallon per square yard.

C. Obtain the Engineer's acceptance of the aggregate base course before beginning construction of the asphalt concrete wearing course.

D. Hot mix asphalt shall be placed on dry, prepared surfaces, when air temperature in the shade of 40 degrees Fahrenheit (F) or warmer, unless otherwise authorized by the Engineer.

E. Placing asphalt pavement during rain or other adverse weather conditions will not be permitted unless otherwise authorized by the Engineer, except that asphalt mix in transit at the time these adverse conditions occur may be placed provided it is of proper temperature, the mix has been covered during transit, and it is placed on a foundation free from mud or free-standing water.

F. Correct any defects in material and workmanship, as directed, when determined detrimental by the Engineer. These include segregation of materials, non-uniform texture, and fouled surfaces preventing full bond between successive spreads of mixture. The corrections or replacement of defective material or workmanship shall be at the Contractor's expense.

G. Compact the bituminous mixture to at least 92 percent of the Theoretical Maximum Density.

H. The finished surface of each course of layer of mixture shall be of uniform texture, smooth, and free of defects and shall closely parallel that specified for the top surface finished grade. Remove and replace boils and slicks immediately with suitable materials.

I. The surface of each layer when tested with a Contractor-furnished 10-foot straightedge shall not vary from the testing edge by more than 0.02-foot for underlying courses of pavements and 0.015-foot for finished top courses or wearing courses of pavements. At no point shall the finished top of the wearing course vary more than 0.03-foot from the specified finished grade.

J. Lift thickness shall be as shown on the drawings or specified, but not to exceed 3 inches.

K. Do not place asphalt concrete pavement on emulsified asphalt (tack coat) until the asphalt separates from the water (breaks) but before it loses its tackiness.

L. Asphalt and sand seal edges where new asphalt concrete meets existing pavement.

3.3 FIELD QUALITY CONTROL

A. Job mix will be sampled immediately behind the paving machine.

B. Temperature of the mix will be measured immediately behind the paver.

C. The theoretical maximum specific gravity of the bituminous mixture will be determined in accordance with ASTM D2041.

D. Properties of the job mix will be measured using ASTM D2041.

E. Density of the compacted job mix will be measured in accordance with ASTM D2922.

3.4 ADJUSTMENT OF EXISTING MANHOLE COVERS AND VALVE BOXES

Prior to placing asphalt concrete pavement, the CONTRACTOR shall make all necessary adjustments to existing manhole frames and covers and valve box covers to ensure that the tops of the manhole covers or valve box lids are flush with the finished grade of the adjoining pavement or ground surface, and that valve boxes and PVC pipes are centered and plumb over operating nut valve.

END OF SECTION

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SECTION 32 31 13 - CHAIN LINK FENCING AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes chain link steel fencing and gates as shown on the Drawings or specified elsewhere. All fences and gates shall be furnished with top rails and knuckled periphery edges.

B. Section includes:

1. Chain link fabric
2. Posts
3. Rails
4. Tension wires
5. Braces
6. Fittings
7. Gates
8. Lock assemblies and gate stops

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Chain Link Fence Manufacturer's Institute:

1. Galvanized Steel Chain Link Fence Fabric
2. Industrial Steel Specifications for Fence-Posts, Gates and Accessories

B. ASTM International (ASTM):

1. A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
2. A313, Standard Specification for Stainless Steel Spring Wire
3. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
4. A491, Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
5. A497, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
6. A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
7. A780, Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
8. A824, Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence

9. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

10. C94, Standard Specification for Ready-Mixed Concrete

11. C150, Standard Specification for Portland Cement

12. C387, Standard Specifications for Packaged, Dry, Combined Materials for Mortar and Concrete

13. F552, Standard Terminology Relating to Chain Link Fencing

14. F567, Standard Practice for Installation of Chain-Link Fence

15. F626, Standard Specification for Fence Fittings

16. F900, Standard Specification for Industrial and Commercial Swing Gates

17. F1043, Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework

18. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

19. F1183, Standard Specifications for Aluminum Alloy Chain Link Fence Fabric

20. F1184, Standard Specifications for Industrial and Commercial Horizontal Slide Gates

21. F1916, Standard Specification for Selecting Chain Link Barrier Systems with Coated Chain Link Fence Fabric and Round Posts for Detention Applications

C. Conflicts in requirements shall use this Section to take precedence.

1.3 SUBMITTALS

A. Section 01 30 00, Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Product Data: Include construction details, material descriptions, dimensions of individual components, and finishes for chain link fences and gates.

2. Fence, gate posts, rails, and fittings.

3. Chain link fabric.

4. Gates and hardware.

C. Manufacturer's recommended installation instructions.

D. Evidence of Supplier and installer qualifications.

1.4 QUALITY ASSURANCE

A. Use skilled workers thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Provide each type of steel fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings, and fastenings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in undamaged condition.

B. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fabric

1. Continuous chain link fence with 2 13/16-inch slats.

2. Height: As shown on the Drawings.

3. Mesh: 3 1/2-inch by 5-inch. All mesh shall have knuckled periphery to eliminate sharp appendages.

4. #9-gauge steel core wire.

5. Top and bottom selvage: Knuckled finish.

6. Galvanized after weaving.

7. Zinc coating shall not be less than 1.2 ounces per square foot.

8. Fabric shall be provided with vinyl coating, colored green and slats shall be green.

B. Line Posts

Line posts shall be hot dipped galvanized 2.375-inch outside diameter hot dipped galvanized pipe, weighing 3.12 pounds per lineal foot.

C. Terminal Posts

End, corner, and pull posts shall be hot dipped galvanized pipe 2.875 inches outside diameter and weighing not less than 4.64 pounds per lineal foot.

D. Top Rail

1. Top rail shall be hot dipped galvanized 1.660-inch outside diameter pipe, weighing 1.83 pounds per lineal foot.

2. Furnish in random lengths of approximately 20 feet.

3. Jointed using a pressed steel or malleable sleeve, not only allowing for expansion and contraction, but also providing a continuous brace from end to end of each stretch of fence.

E. Tension Wire

Bottom tension wire shall be #6-gauge heavy galvanized high carbon steel coil spring wire, securely fixed to the fabric, line posts, and terminal posts.

F. Braces

1. All terminal posts shall be braced with 1.660-inch outside diameter. horizontal pipe bracing of the same material as the top rail, securely attached to the terminal and first line post with malleable iron fittings.

2. Braces shall be truss-braced from the first line post to the bottom of the terminal post, with a 3/8-inch galvanized truss rod assembly.

3. Corner posts shall be braced in both directions.

G. Fittings

1. Malleable, cast iron, or pressed steel.
2. Hot dip galvanized.

H. Fabric Ties

1. #11-gauge galvanized wire ties shall be used to tie the fabric to the line posts and rails.

I. Chain Link Gates

1. Frames:

   a. Made of heavy galvanized 1.90-inch outside diameter pipe, weighing 2.28 pounds per lineal foot.

   b. Welded or assembled with corner fittings.

2. Corner fittings, ball and socket hinges, catch stops, and center rest to be heavy galvanized malleable iron.

3. Hinges as required.

4. Provide diagonal cross-bracing.

J. Gate Posts

Posts shall be hot dipped galvanized pipe 2.875-inch outside diameter weighing 4.64 pounds per lineal foot.

K. Framework Material

All posts, rails, and braces to be heavy galvanized.

L. Lock Assembly and Gate Stop

1. Provide for each gate one double-hasp drive gate drop rod lock assembly set in concrete and one gate stop set in concrete.

2. All lock assemblies and gate stops shall be fabricated from heavy galvanized malleable iron.

3. Provide one vandal-proof keyed lock and three keys for each gate assembly.

M. Knox-Box® Bracket

Provide heavy duty galvanized bracket and brace bands for mounting Knox-Box® to gate post.

N. Vertical Privacy Slats

Vertical privacy slats (inserts) shall be extruded high density polyethylene (HDPE), bottom locking design. Color to be green.

PART 3 EXECUTION

3.1 INSTALLATION

A. All materials and workmanship shall be first class in all respects and shall be done in a neat and workmanlike manner.

B. Installation shall be conducted in accordance with the requirements of the Chain Link Fence Manufacturers Institute and these Drawings & Specifications.

C. All line, terminal, gate stops, gate drop, and gate posts shall be fixed with a minimum of 3-foot embedment in concrete poured into a 1-foot diameter hole and plumb upon curing of the concrete.

D. Line posts shall be spaced not further than 10-foot on-center.

E. Gates shall have 3-inch clearance above ground surface and sized for the application shown.

F. Space ties at 14 inches on center.

END OF SECTION

SECTION 32 91 13

SOIL PREPARATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. The work covered in this section consists of furnishing all labor, materials and equipment for testing, preparation, and placement of topsoil and compost as indicated by the drawings and as specified.

2. Coordinate placement of topsoil and required soil amendments with the establishment of rough grades.

3. Coordinate depths of soil amendments and topsoil with grading specifications for rough and finish grades.

4. All rough grading operations shall be completed as required by these specifications. Topsoil placement or backfilling in areas to be landscaped shall not occur until the Owner's Representative has issued written approval of the rough grade and topsoil.

B. Related Sections include the following:

1. Section 32 80 00; Irrigation System – NOT USED
2. Section 32 92 00; Turf and Grasses
3. Section 32 93 00; Plants

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

H. Finish Grade: Elevation of finished surface of planting soil.

I. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

J. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

K. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

L. Planting Area: Areas to be planted.

M. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

N. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

O. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

P. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

Q. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

R. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

S. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

T. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

1.4 SUBMITTALS

A. At least 20 working days prior to use on site the Contractor shall submit the following information to the Owner's Representative.

1. Certified analysis of compost mixture components required by these specifications.

a. Compost Analysis: Furnish analysis by a qualified testing laboratory stating pH range, moisture content, particle size (sieve analysis), soluble salt content, and percentage of inert materials.

2. Certified analysis of Planting soil (blended soil/compost mix)

3. Certified analysis of on-site or imported topsoil required by these specifications.]

a. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; [sodium absorption ratio;] deleterious material; pH; and mineral and plant-nutrient content of topsoil.

b. Report suitability of tested soil for plant growth.

c. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd. (0.76 cu. m) for nitrogen, phosphorus,

and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

d. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action

e. Available Testing Laboratories:

f. Soil and Plant Laboratory, Inc. – www.soilandplantlaboratory.com

g. Western Agricultural Laboratories – www.al-labs-west.com

4. Where any tests show results failing to conform to the required standards the Contractor shall include with the testing report a recommended treatment plan to bring the material into conformance.

1.5 QUALITY ASSURANCE

A. Soil Preparation - All soil preparation work shall be done under the supervision of a Contractor having experience in landscape construction. All work shall be done in accordance with proper horticultural practices.

B. Herbicide Application - Applications of herbicide for weed control, as required, shall be made only by an applicator currently licensed under State and Federal law.

C. The Contractor shall store fertilizer and other required materials in a dry place and free from the intrusion of moisture.

D. Soil/Compost Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

1.6 PROJECT CONDITIONS

A. Prior to the work of this section all rough graded surfaces shall be free of:

1. Concrete, asphalt, and other construction debris;
2. Limbs, twigs, cones, seed-pods and other woody material; and
3. Rock, gravel or other material not suitable for plant growth.

B. In all plant bed areas the sub-grade shall be free of unsuitable material such as stumps, roots, rocks, concrete, asphalt, or metals, for a minimum depth of 24 inches and in all lawn or seeded areas the sub-grade shall be free of unsuitable material for a minimum depth of 12 inches.

C. The Contractor shall provide protective covers and barriers as necessary to prevent damage and staining to all site improvements.

D. The Contractor shall prepare topsoil only when weather and soil conditions allow. Do not attempt soil preparation work when weather or soil conditions would contribute to poor or improper mixing, voids, or other adverse conditions.

E. The Contractor shall take all reasonable precautions to prevent runoff of topsoil and fertilizers from leaving site or entering storm systems, or any waterway.

1.7 SEQUENCING AND SCHEDULE

A. Coordinate soil preparation work with installation of other site improvements and planting of trees, shrubs, ground covers and lawns.

PART 2 PRODUCTS

2.1 PLANTING SOILS GENERAL

A. Planting Soil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 6 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Ratio of Loose Compost to Topsoil by Volume: 1:4.

2. Ratio of Sand to Topsoil by Volume: 1:10.

3. Weight of Lime per 1000 Sq. Ft.: As indicated by soils report.

4. Weight of Sulfur Iron, Sulfate or Aluminum Sulfate per 1000 Sq. Ft.: As indicated by soils report.

5. Weight of Agricultural Gypsum per 1000 Sq. Ft.: As indicated by soils report.

6. Weight of Bonemeal per 1000 Sq. Ft.: As indicated by soils report.

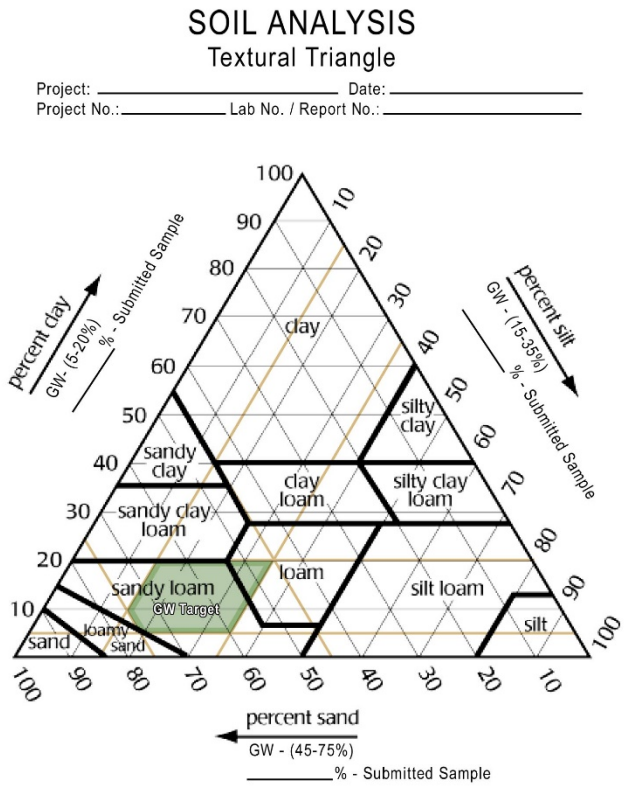
7. Weight of Superphosphate per 1000 Sq. Ft.: As indicated by soils report.

8. Weight of Commercial Fertilizer per 1000 Sq. Ft.: As indicated by soils report.

9. Weight of Slow-Release Fertilizer per 1000 Sq. Ft.: As indicated by soils report.

B. Topsoil Soil Textural Class Requirements: Topsoil textural analysis shall fall within the following gradations:

Textural Class	% of Total Weight	Average %
Sand (0.05-2.0 mm dia.)	45-75	60
Silt (0.002-0.0 mm dia.)	15-35	25
Clay (less than 0.002 mm dia.)	05-20	15



C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources combined with soil amendments to produce acceptable planting soil.

1. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

D. On-Site Amended Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process combined with soil amendments to produce acceptable planting soil and stockpiled on-site.

1. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

2. Supplement with planting soil when quantities are insufficient.

E. Revise first subparagraph below if a specific type of liming material (ground dolomitic limestone, calcitic limestone, mollusk shells, or other type) is required; coordinate with "Inorganic Soil Amendments" Article.

F. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of weeds and invasive plants including but not limited to:

1. Cirsium arvense (Canadian Thistle)
2. Convolvulus spp. (Morning Glory)
3. Cytisus scoparus (Scotch Broom)
4. Dipsacus sylvestris (Common Teasel)
5. Festuca arundinaceae (Tall Fescue)
6. Hedera helix (English Ivy)
7. Holcus canatus (Velvet Grass)
8. Lolium spp. (Rye Grasses)
9. Lotus corniculatus (Bird's Foot Trefoil)
10. Lythrium salicaria (Purple Loose Strife)
11. Melilotus spp. (Sweet Clover)
12. Myriophyllum spicatum (Eurasian Milfoil)
13. Phalaris arundinaceae (Reed Canary Grass)
14. Rubus discolor (Himalayan Blackberry)
15. Solanum spp. (Nightshade)
16. Trifolium spp. (Clovers), and
17. Not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.

2. Class: Class O, with a minimum 95 percent passing through No. 8 sieve and a minimum 55 percent passing through No. 60 sieve.

3. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.3 COMPOST

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 10-gram tablets.

2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.5 PRE-EMERGENT HERBICIDE

A. Pre-emergent herbicide shall be as directed for condition by currently licensed herbicide applicator.

2.6 POST-EMERGENT HERBICIDE

A. Post-emergent herbicide shall be as directed for condition by currently licensed herbicide applicator.

2.7 WATER

A. Water shall be suitable for irrigation, free from oil, acid, alkali, salt or other substances harmful to plant life.

PART 3 EXECUTION

3.1 EXAMINATION

A. The Contractor shall examine the entire site for conditions that will adversely affect execution, permanence and quality of work, and survival of plant materials. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Rough Grading Inspection - Contractor shall notify Owner's Representative a minimum of 72 hours in advance for inspection of rough grades.

C. The Contractor shall verify that rough grades and slopes of areas to be planted areas are set at sufficient depth to allow for placement of specified materials. If the site is not suitable for landscaping operations, the Contractor shall perform necessary corrective work.

3.2 GENERAL PREPARATION OF GROUND SURFACES – ALL PLANTING OR SEEDING AREAS

A. The Contractor shall eliminate uneven areas and low spots, remove lumber, stones, sticks, mortar, concrete, rubbish, debris, contaminated soil and any other material harmful to plant life, in shrub and ground cover beds.

B. The Contractor shall verify that invasive species and weeds have been eliminated prior to the placement of topsoil. The Contractor must not place topsoil until all living weed matter has been eliminated.

C. Weed eradication shall include herbicide and non-herbicide methods. Eradication shall include and is not limited to elimination of the following invasive species and weeds;

Cirsium arvense (Canadian Thistle)
Convolvulus spp. (Morning Glory)
Cytisus scoparus (Scotch Broom)
Dipsacus sylvestris (Common Teasel)
Festuca arundinaceae (Tall Fescue)
Hedera helix (English Ivy)
Holcus canatus (Velvet Grass)
Lolium spp. (Rye Grasses)
Lotus corniculatus (Bird's Foot Trefoil)
Lythrium salicaria (Purple Loose Strife)
Melilotus spp. (Sweet Clover)
Myriophyllum spicatum (Eurasian Milfoil)
Phalaris arundinaceae (Reed Canary Grass)
Rubus discolor (Himalayan Blackberry)
Solanum spp. (Nightshade)
Trifolium spp. (Clovers)

1. Herbicide application shall be by manual 'spot spraying', wicking, or backpack methods per manufacturer's specifications.

2. Herbicide application shall be as directed by a currently licensed applicator and shall be strictly applied by manufacturer's specifications, and applicable codes and regulations.

3. Remove invasive plant material after herbicide application has effectively stopped plant growth. Dispose legally off-site.

4. After initial spraying and removal of weeds, and prior to placing topsoil, the contractor shall water the subgrade sufficiently to germinate dormant weed seeds.

    a. Prior to this weed crop producing seeds, the contractor shall spray these weeds with herbicide and remove them from the site.

    b. Before continuing with topsoil placement the contractor shall verify with the Owner's Representative whether or not to repeat this treatment.

5. Selective hand removal by non-herbicide methods shall be utilized if herbicide application threatens existing plantings.

6. Existing or new plantings damaged or killed by herbicide application shall be replaced immediately at no additional cost to the Owner.

3.3 PLACING PLANTING SOILS

A. Planting soils shall be placed in minimum depths of 12 inches in planting beds, and 4 inches in seeded lawn areas.

B. Verify that planting soil is stockpiled in sufficient quantities to be placed at depths specified. The Contractor shall notify the Owner's Representative immediately if supplies are inadequate or do not meet specifications for topsoil. The Contractor shall provide imported topsoil meeting the requirements of this section if the supply of existing on-site topsoil is insufficient.

C. Planting soil shall be placed at specified grades between any existing or constructed points on the site, such as curbs, walls, walks and paving.

3.4 SOIL PREPARATION IN PLANTING BEDS

A. Loosen subgrade of planting beds to a minimum depth of 8 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply superphosphate fertilizer directly to subgrade before loosening.

2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.

    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

    b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil mix to a depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

    a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil mix.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.5 SOIL PREPARATION IN SEEDED AREAS

A. Limit seeded subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply superphosphate fertilizer directly to subgrade before loosening.

2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.

    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

    b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

    a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil mix.

C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

2. Loosen surface soil to a depth of at least of 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.

    a. Apply superphosphate fertilizer directly to surface soil before loosening.

3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.

4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.6 CLEANUP

A. Keep project site free from accumulation of debris, topsoil, and other material.

B. At completion of each area of work, completely remove debris, equipment and surplus materials.

C. Any paved area or surfaces stained or soiled from landscaping materials shall be cleaned with a power sweeper using water under pressure. Building surfaces shall be washed with proper equipment and materials as approved by the Owner’s Representative.

END OF SECTION

SECTION 32 92 00

TURF AND GRASSES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work consists of providing all labor, material and equipment for installing and establishing seeded Lawn as indicated below.

1. Plant and establish seed mixture(s) in areas shown on drawings.

B. Related Section include the following:

1. Section 32 80 00; Irrigation System – NOT USED
2. Section 32 91 13; Soil Preparation
3. Section 32 93 00; Plants
4. Section 32 01 00; Maintenance of Exterior Improvements – NOT USED

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

1.5 QUALITY ASSURANCE

A. Work performed as described in this section shall be done under the supervision of a contractor having experience in landscape construction.

B. Work and material supplied shall comply with applicable requirements of the United States Department of Agriculture (USDA).

C. Delivery, Storage, and Handling

1. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, and date of packaging and location of packaging. Damaged packages are not acceptable.

2. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.6 PROJECT CONDITIONS

A. Season: Seed between March 15 and April 15 or September 15 and October 15.

B. Weather conditions: Seeding is not permitted during the following conditions:

1. Cold weather: When air or surface temperature is less than 32 degrees F.
2. Hot weather: When air temperature is greater than 80 degrees F.
3. Soil Temperature: When soil temperature is less than 55 degrees F.
4. Wet weather: When ground becomes saturated.
5. Windy weather: When wind velocity is greater than 10 mph.

1.7 WARRANTY

A. The warranty of plant materials furnished and planted under this contract shall be for one full year from the date of Substantial Completion and written acceptance as specified herein.

B. At the end of the warranty period, all seeded areas not meeting requirements of these specifications shall be reseeded with the same species and size as originally specified. Such replacement shall be made in the same manner as specified for the original plantings, and at no extra cost to the Owner. The warranty on reseeded areas shall be extended for one full season's cycle after reseeding has been completed.

PART 2 PRODUCTS

2.1 SEED MIXTURES

A. General

1. Seed shall meet or exceed Blue Tag quality according to current Oregon Certified Seed Standards published by Oregon State University.

2. Seeds shall be labeled in accordance with USDA Rules and Regulations under the Federal Seed Act.

3. Seeds shall be furnished in sealed, standard containers unless written exception is granted.

4. Noxious weed seed not to exceed 1% by weight.

5. Seed that is wet or moldy or has been damaged in transit will not be accepted.

B. Erosion control grass seed mixture shall be: Sunmark Prairie Mix " " or approved equal. Application rate: 1 lbs. /1,000 square feet.

Botanical name	Common Name	Percent by Seed Count
Festuca rubra rubra	Native Red Fescue	45%
Bouteloua gracilis	Blue Grama	25%
Buchole dactyloides	Buffalograss	20%
Koeleria macrantha	Prairie Junegrass	7%
Trifolium fragiferum	Strawberry Clover	3%

C. The Contractor shall furnish suppliers certificate guaranteeing that the seed conforms to the above requirements and USDA certification. Seed shall be delivered to the contract site in unopened containers bearing the USDA and suppliers certificates.

2.2 WATER

A. Water shall be free from oil, acid, alkali, salt and other substances harmful to growth of grass, and shall be from a source approved prior to use.

2.3 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

D. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

E. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

F. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.4 SPECIAL SEEDING AND MULCHING EQUIPMENT

A. Hydraulic equipment used for the application of fertilizer, seed and slurry of prepared wood-cellulose fiber shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix the slurry specified. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of spray nozzles that will provide even distribution of the slurry on the various slopes.

PART 3 EXECUTION

3.1 GENERAL PREPARATION

A. Verify that grading and soil preparation has been completed correctly.

1. Notify Owner's Representative of any discrepancies; do not proceed with work until discrepancies have been resolved.

B. Notify Owner's Representative at least 24 hours prior to planting or seeding operations. Owner's Representative will inspect soil preparation, plant materials and plant orientation.

3.2 SEEDBED PREPARATION

A. Limit subgrade preparation to areas to be planted. Prepare Seeded areas as directed in Division 32, Soil Preparation.

3.3 SEEDING (ALL SEEDED AREAS)

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at previously indicated rates.

C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:6 with erosion-control fiber mulch and 1:4 with erosion-control blankets or mats installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into topsoil with suitable mechanical equipment.

2. Bond straw mulch by spraying with asphalt emulsion at the rate of 10 to 13 gal. /1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

F. Protect seeded areas from hot, dry weather or drying winds by applying peat mulch within 24 hours after completing seeding operations. Soak and scatter uniformly to a depth of 3/16 inch and roll to a smooth surface.

3.4 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.

2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lbs. /acre dry weight but not less than the rate required to obtain specified seed-sowing rate.

3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at a minimum rate of 500-lbs. /acre dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lbs. /acre.

3.5 TURF RENOVATION

A. Renovate existing turf.

B. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing lawn.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 4 inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.6 FIRST MOWING

A. No mowing is required for erosion control seeded areas.

3.7 ACCEPTANCE OF SEEDED AREAS

A. Satisfactory Seeded Areas: Unless otherwise specified all seeded areas shall at the time of substantial completion, exhibit a healthy, uniform, close stand of the specified seed mix, free of weeds and surface irregularities, with coverage of mix in specified proportions, exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Reestablish turf that does not comply with requirements and continue maintenance until lawns are satisfactory.

3.8 CLEANUP, PROTECTION AND ACCEPTANCE

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required protecting newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

D. Obtain written Conditional Acceptance from the Owner's Representative after all turf areas have been mowed at least twice.

END OF SECTION

SECTION 32 93 00

PLANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Furnishing all labor, materials and equipment for installation of landscape planting as shown on the drawings and as specified.

B. Related Sections include the following:

1. Section 32 80 00; Irrigation System – NOT USED
2. Section 32 91 13, Soil Preparation
3. Section 32 92 00, Turf and Grasses
4. Section 32 01 00, Maintenance of Exterior Improvements – NOT USED

1.3 DEFINITIONS

A. The following publications, referred to thereafter by basic designation only, form a part of this specification to the extent indicated by references:

1. STANDARDIZED PLANT NAMES, 1942 Edition, published by J. Horace McFarland Company.

2. FLORA OF THE PACIFIC NORTHWEST; by Hitchcock and Cronquist, latest edition,

3. Federal Standard for Fertilizers - Mixed, Commercial: FS0-F-241D

B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1, latest edition, for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum-laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1, latest edition.

C. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1, latest edition, for type and size of plant required.

D. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1, latest edition, for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1, latest edition, for type and size of plant required.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1, latest edition, for type and size of plant.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Groundcover: Low woody or herbaceous plants generally less than 24 inches high at maturity or per jurisdictional definition.

I. Healthy (Plants): Plants that are growing in a condition that expresses leaf size, crown density, color, and with annual growth rates typical of the species and cultivar's horticultural description, adjusted for the planting site conditions, drainage and weather conditions.

J. Kinked root: A root within the root package that bends more than 90 degrees.

K. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

L. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.4 SUBMITTALS

A. Submit certifications, or samples of material requested for substitution.

B. A maximum of 1 month after the Contractor receives the authorization to proceed, the Contractor shall submit to the Owner's Representative, copies of all nursery invoices for plant materials to be used on site. The copies must indicate source of supply by name, address and phone number, order invoice number, and size and quantity for each species or variety ordered.

C. Inspection certificates:

1. All plant material shall meet requirements of State and Federal laws with respect to inspection for plant diseases and infestation.

2. Inspection certificates required by law shall accompany each shipment of plant materials and be submitted to the Owner's Representative.

1.5 QUALITY ASSURANCE

A. Work and material supplied shall comply with applicable requirements of the United States Department of Agriculture (USDA).

B. The Contractor shall protect all materials, at all times during handling, shipping and storage, from extreme weather conditions, wind, drying of roots or root ball injury.

1. Store fertilizers in a dry place and protect from intrusion of moisture.
2. Deliver plants at the time of planting, and handle with proper horticultural practice.

C. Plant materials showing damage from handling, shipping or during planting shall be rejected by the Owner's Representative and shall be replaced by the Contractor at their expense.

D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in the latest edition of ANSI Z60.1, "American Standard for Nursery Stock."

1. Selection of exterior plants purchased under allowances will be made by Owner's Representative, who will tag plants at their place of growth before they are prepared for transplanting.

E. Tree and Shrub Measurements: Measure according to ANSI Z60.1, latest edition, with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

F. Observation: Owner's Representative may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Owner's Representative retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site and replace.

G. Store fertilizers in a dry place and protect from intrusion of moisture.

H. Planting

1. All landscaping work shall be done under the supervision of a Contractor currently licensed in landscape construction, under respective jurisdictions, and having a minimum of two years of experience in landscape construction. All work shall be done in accordance with proper horticultural practices and hereinafter described.

2. Installer's Personnel Certifications: Certified Landscape Technician, CLT-Exterior or Certified Ornamental Landscape Professional, COLP.

I. Herbicide Application

1. Application of herbicides for weed control as may be required shall be made only by an applicator currently licensed under this state's law.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

B. Do not prune trees and shrubs before delivery, except as approved by Owner's Representative. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots in water for two hours if dried out.

2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.

3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.7 PROJECT CONDITIONS AND COORDINATION

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Planting Season: West of Cascade Mountains, September 1 – May 15, unless otherwise specified; container grown materials located in irrigated areas may be planted at other times depending upon written approval by Owner's Representative.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions are between 35- and 80-degrees Fahrenheit and soil conditions are not saturated.

C. Coordination with seeded, plugged and sodded areas: Plant trees and shrubs after finish grades are established and before seeding, plugging and sodding designated areas, unless otherwise acceptable to Owner's Representative.

1. When planting trees and shrubs after seeding, plugging and sodding, protect these areas and promptly repair damage caused by the planting operations.

D. The Contractor shall coordinate planting work with soil preparation.

1.8 PLANT MATERIALS SUBSTITUTION

A. Plants, not specifically named in the plant list, will not be accepted unless specifically accepted in writing by the Owner's Representative.

B. Substitutes proposed for approval, in each case, shall possess the same essential characteristics as the kind of plant actually specified in regard to appearance, ultimate height, shape, and habit of growth, general soil, and other environmental requirements.

1.9 WARRANTY

A. The Owner shall be responsible for operating and maintaining the drip irrigation system installed by the Contractor to maintain the health of the plants and provide good growing conditions.

B. The Owner will be responsible for all plant maintenance including weeding, removal and replacement of any damaged or dead plants during the establishment period.

PART 2 PRODUCTS

2.1 TREES, SHRUBS AND GROUNDCOVER

A. General species, variety, quantity, size and condition of plant will be provided as indicated on the drawings.

Plant material shall be supplied, but not limited to form and conditions defined as follows:

Rhizome:	Section of root or stolon
Propagules:	Section of stem
Bulb:	Single bulb mass

Plug:	Rooted Cutting
Aquatic container:	Water filled container for floating plants
Seedling:	Rooted tree or shrub
Tubeling:	Rooted tree or shrub in single tube
Bare Root:	Shrub or tree with soil removed from root mass
Cutting:	Stem cut from parent stock
Ball and Burlap:	Tree or shrub with excavated root ball wrapped and tied
Container:	Standard pot or bag, per ANSI standard sizing.

B. Nomenclature shall conform to "Standardized Plant Names."

C. Quality definitions, grading tolerances, and caliper to height ratios no less than minimum specified in ANSI Z60.1.

D. Plant material shall be healthy nursery stock, well branched, full foliated when in leaf, free from disease, injury, insects, all weeds and weed roots.

E. Cold storage plants shall not be permitted.

F. Plant materials shall be nursery-grown unless otherwise specified. Nursery-grown plants shall have been growing continuously in licensed nurseries for the following minimum number of growing seasons:

Plant Materials	Time in Nursery
Evergreens and conifers	Two growing seasons
Deciduous	One growing season
Groundcover and Vines	One growing season

G. Balled and burlapped (B&B) stock shall be furnished with natural ball.

H. Potted and container stock shall be well rooted, vigorous enough to ensure survival and exhibit healthy growth.

I. Container stock shall have been growing in its container for a minimum of six (6) months and a maximum of two (2) years, with roots filling the containers but not showing evidence of being or having been root bound.

J. Trees: Provide untapped, straight, single-leader trees.

K. Plant materials shall be free from disease, insects, disfiguring knots, sun scale, injuries, bark abrasion, evidence of improper pruning and other objectionable disfigurements.

L. Trees and shrubs shall have all developed branching system; shrubs shall have full foliage and shall not be leggy.

M. Thin, weak, leggy, or misshapen plants will be rejected by the Owner's Representative.

N. Labels: The correct horticultural name, size and caliper and/or other data, as specified in the Plant Material List, written on durable labels in weather-resistant ink, shall be securely attached to all individually shipped plants and to each box, bundle, bale and container of plant materials. Labels shall remain on representative plant materials until final acceptance of planting. Labels shall be affixed in such a manner that will not girdle the plant materials.

O. The species (botanical and common names), size, manner in which the plants are furnished, and spacing of the required plant materials, are noted on the planting plan.

P. The quantities of plant materials shall be as determined by the Contractor in accordance with the specified spacing, or location on plan. Surplus or shortages of plant quantities shall be the responsibility of the Contractor.

2.2 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new softwood with specified wood pressure-preservative treatment, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.

2. Retain one of first two subparagraphs below.

3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes.

2.3 WATER

A. Water shall be suitable for irrigation, free from oil, acid, alkali, salt or other substances harmful to plant life.

2.4 MULCHES

A. Fir and/or hemlock bark, 1-inch minus size with less than 30% bark finer than 1/4-inch size. Sawdust and wood shavings will not be acceptable.

2.5 MISCELLANEOUS PRODUCTS

A. Wood Pressure-Preservative Treatment: AWPA C2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic; including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.

B. Root Barrier: Black, molded, modular panels manufactured with 50 percent recycled polyethylene plastic with ultraviolet inhibitors, 85 mils thick, with vertical root

deflecting ribs protruding 3/4 inch out from panel, and each panel 24 inches high and wide.

C. Anti-desiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

D. Burlap: Non-synthetic, biodegradable.

E. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb. of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb. of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 EXECUTION

3.1 INITIAL INSPECTION OF PLANT MATERIAL

A. All plant materials must be inspected by the Owner's Representative before planting. All plant material shall be free from insects, diseases, and injuries and sizing shall be equal to or exceeding measurements specified. Transport and handle all materials in strict accordance with proper horticultural standards. The Contractor shall provide plants with habit and growth that is normal, sound, healthy and vigorous.

B. All plant materials not meeting specification requirements shall be rejected.

C. All native plants shall be nursery stock except hardwood cuttings. Nursery stock shall be grown from propagules or seed collected from western Oregon or western Washington sources only. Plants from off-site collection sources shall not be allowed, unless otherwise approved by the Owner's Representative.

D. Hardwood cuttings, as identified on the plant list, shall be taken from healthy, vigorous, one to three-year old, plants grown in full sunlight and obtained from the respective watershed identified by the Owner's Representative. Cuttings shall be from 1 to 2 feet in length and between ¼ and ¾ inches in diameter, as shown on plans. Each piece shall contain a minimum of two dormant buds per foot of length. Period of collection shall be at dormancy and at the optimum time per proper horticultural standards for cutting establishment.

3.2 PLANT BED PREPARATION

A. Prepare plant beds as directed in Division 32, Soil Preparation.

3.3 PLANT LAYOUT AND INSPECTION

A. Layout of major planting areas as indicated on the plans are approximate only, and the locations and identity of all trees, shrubs, ground covers and other plantings shall be outlined in the field by the Contractor, subject to review and approval by the Owner's Representative.

B. Inspection: The Contractor shall notify the Owner's Representative forty-eight (48) hours prior to beginning any planting. The Owner's Representative may adjust plant material location to meet field conditions. Planting shall not occur until the Owner's Representative has approved the location and layout of all plant beds.

3.4 TREES, SHRUBS, GROUNDCOVER AND OTHER PLANTINGS

A. Plant trees and shrubs upright and adjust to set best appearance or relationship to adjacent plants and structures. Shrubs and groundcovers shall be planted one half the distance from curbs, sidewalks, buildings and other objects, as specified in the spacing requirements.

Native Plant material shall be planted with regard to condition specified on plan, per, but not limited to the following:

Rhizome:	Cut into soil surface within 2 inches of surface
Propagule:	Cut into soil surface within 2 inches of surface
Bulb:	Set into soil 4 inches- 6 inches deep; point up
Plug:	Placed into soil at size of root mass
Aquatic container:	Dispersed into open water surface
Seedling:	Cut into soil as deep as root mass, compacted
Tubeling:	Cut into soil as deep as root mass, compacted
Bare Root:	Placed into plant pit sufficient for root mass, compacted
Cutting:	Dibble into soil per cutting installation detail on plan
Ball and Burlap:	Placed into plant pit twice the size of root ball, compacted
Container:	Placed into plant pit twice the size of container

B. Planting dates:

1. Planting of burlapped and container stock: Feb.15 - May 15, Oct. 1-Nov. 15.

C. Excavation for planting

1. Stockpile all excavated topsoil for planting operations.

2. In digging pits for trees, the contractor shall separate sod, topsoil suitable for backfill, and subsoil, and shall dispose of the sod, rocks and unsuitable material off-site.

3. Diameter or minimum width of planting pit or trenches shall be as shown on the drawings.

4. If standing water is encountered during excavation of the planting pits, the Contractor shall notify the Owner's Representative who will determine the corrective drainage measures required.

5. If underground obstructions or rocks are encountered in excavation of planting areas making it impossible to plant materials as shown on the contract documents, an alternate location for the planting shall be selected by the Owner's Representative.

6. Excess excavated topsoil shall be used to form saucers around plants as detailed. Soil not required or suitable for the above usage shall be properly disposed of off the project site.

7. Root crown to be visible before tree is set. Remove top of root ball media to locate if needed.

8. Burlap, twine and metal basket to be cut and removed entirely down to base of rootball after tree is set (material on bottom can remain). If rootball is unstable or breaking, only remove the top 12" of burlap.

9. Staking to remain no more than two years unless Owner's Representative directs longer staking period. Maintain 2" strap slack around trunk.

D. Cutting: Cut off cleanly all broken or frayed roots, smaller than 1/2 inch caliper.

E. Prior to completing backfilling, the upper two-thirds of the plant pit shall be flooded with the plant starter solution. Allow solution to soak away. Finish filling holes to finish grade and lightly compact soil around root ball.

F. Placement and compaction: Place and compact backfill soil mixture carefully to avoid injury to roots; fill all voids.

3.5 SHRUBS AND GROUNDCOVER PLANTING BED GRADES

A. Establish finish grades and slopes in accordance with finish grades as specified.

3.6 MULCHING

A. Mulch all shrubs and ground cover planting beds with a 2 inch layer of mulch material within two (2) days after planting. Cover entire bed areas; apply evenly. A 2 inch layer of mulch material shall be applied to saucer areas of trees and shrubs located outside of planting beds.

3.7 TREE STABILIZATION

A. Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to the dimension shown on Drawings above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.

2. Use two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees above 12 feet high.

3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.8 ROOT-BARRIER INSTALLATION

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings. Length shall be 6'each side of tree center (12' total length).

3.9 ANTIDESICCANT

A. The application of the antidesiccant shall be prior to transplanting as a spray or during planting as a dip. The antidesiccant shall not be applied if rain is anticipated in one hour or less. If not previously applied, the Contractor shall, within 24 hours of completing backfilling, spray all evergreen and leafed-out deciduous plants with the antidesiccant thoroughly covering all leaves. The solution shall be mixed according to manufacturer's specifications.

3.10 PRUNING

A. Pruning shall be done at or after the time of planting in accordance with proper horticultural practice.

B. Pruning shall be limited to the minimum necessary to remove injured twigs and branches and to compensate for the loss of roots during transplanting but shall never exceed one-half of the branching structure.

1. Crossed or rubbing branches shall be removed providing the natural shape of the tree is preserved.

2. All cuts shall be made flush with the parent stem leaving no stubs. Pruning cuts shall be made in a manner to favor the earliest possible covering of the wound by callus growth. Cuts that produce large wounds and weaken the tree will not be acceptable. Evergreens shall not be pruned except to remove injured branches

and/or double leaders. The use of pole shears and/or hedge shears for pruning deciduous and evergreen trees will not be permitted. All trimmings and other debris left over from the planting operations shall be collected and disposed of legally off the site.

C. With the permission of the Owner's Representative, pruning may be done before delivery of plants, but not before plants have been inspected and accepted.

3.11 CLEANUP

A. Keep premises free from accumulation of debris.

B. At completion of each area of work, remove all debris, equipment and surplus materials

END OF SECTION

SECTION 33 05 17 - PRECAST CONCRETE VALVE VAULTS AND METER BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete valve vaults.
2. Precast concrete meter boxes.

1.2 RELATED SECTIONS

A. Section 05 50 00, Metal Fabrications
B. Section 31 05 16, Aggregates for Earthwork
C. Section 31 23 16, Excavation
D. Section 31 23 23, Fill

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
3. ASTM A536 - Standard Specification for Ductile Iron Castings.
4. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
6. ASTM C33 - Standard Specification for Concrete Aggregates.
7. ASTM C150 - Standard Specification for Portland Cement.
8. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
9. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
10. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
11. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
12. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.

13. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

14. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

15. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

16. ASTM D4104 - Standard Test Method (Analytical Procedure) for Determining Transmissivity of Nonleaky Confined Aquifers by Overdamped Well Response to Instantaneous Change in Head (Slug Tests).

17. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 COORDINATION

A. Coordinate Work with utilities within construction area.

B. The drawings identify precast vaults and meter boxes by manufacturer and model number. This information is provided for dimensional information only. Provide precast items in accordance with the requirements of this Section.

1.5 PREINSTALLATION MEETINGS

A. Convene a minimum of 1-week prior to commencing Work of this Section.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on valve vaults and meter boxes.

C. Shop Drawings for Precast Concrete Valve Vaults:

1. Indicate plan, location, and inverts of connecting piping.
2. All interior and exterior dimensions.
3. Location and type of lifting inserts, connection embeds, and joints.
4. Details of reinforcement.
5. Covers or hatches.
6. Ladders and grating.

D. Manufacturer's Certificate: Certify that precast concrete valve vaults and meter boxes meet or exceed ASTM standards and specified requirements.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and inverts of buried pipe, components, and connections.

1.8 QUALITY ASSURANCE

A. Perform Work according to standards identified in Article 1.2 herein.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Transport and handle precast concrete units with equipment designed to protect units from damage.

C. Storage:

1. Store precast concrete valve vaults and meter boxes according to manufacturer instructions.

2. Do not place concrete units in position to cause overstress, warping, or twisting.

PART 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Performance and Design Criteria:

1. Watertight, Precast, Reinforced, Air-Entrained Concrete Structures:

a. Manufactured to conform to ASTM C913.

2. Loading:

a. Design to ASTM C890-A16 / AASHTO HS20 live loading and installation conditions.

b. Where vaults are below grade, a dead load of 125 pounds per cubic foot shall be added for the soil.

c. Lateral loads:

1) Static: 105 x Depth of fill per square foot (psf) triangular equivalent fluid pressure plus a surcharge of an additional 3 feet of soil depth in areas subject to vehicular traffic (assume traffic load in all areas, unless indicated otherwise by the Contract Documents).

2) Seismic acceleration: UBC Zone 3 requirements (I = 1.25) where I = importance factor, I = 1.25, but not less than 0.20 grams (g) acting on structure mass. Seismic loading need not be considered simultaneously with traffic surcharge.

3. Minimum 28-Day Compressive Strength: 3,000 pounds per square inch (psi).

4. Honeycombed or re-tempered concrete is not permitted.

5. No knockouts shall be cast into vault walls. All pipe penetrations shall be pre-formed or core-drilled at the required locations.

6. Accessories: Accessories such as ladders, floor grates at sumps, and other features shall be provided as shown on the Drawings.

7. Size: Vault dimensions shall be as required by the Drawings.

2.2 PRECAST CONCRETE VALVE VAULTS

A. Manufacturers:

1. Manufacturer shall be Oldcastle Precast, Inc, or approved equal.

B. Valve Vault Frames and Covers:

1. Cast Iron Castings:

a. ASTM A48, Class 30 or better.
b. Free of bubbles, sand, air holes, and other imperfections.

C. Access Steps:

1. Steel reinforced formed polypropylene:

a. ASTM C478
b. Reinforced rod: ASTM A615, Grade 60, 1/2-inch diameter

2. Aluminum: ASTM B221, Alloy 6061-T6

3. Width: Minimum 12 inches

4. Spacing: 12 inches on center vertically.

2.3 METER BOXES

A. As specified in the Plans.

2.4 ACCESS HATCHES AND LIDS

A. Unless noted otherwise elsewhere in the Contract Documents, vaults shall have concrete top slabs with access openings as shown on the Drawings.

B. Vault manufacturer shall provide the access hatches per the requirements of Section 05 50 00, Metal Fabrications.

C. Lids shall have lifting holes.

D. When leveling bolts are used to set the vault top sections, ensure the load from the top slab is transferred through grout to the vault walls so that the load is not carried by the leveling bolts.

2.5 MATERIALS

A. Portland Cement:

1. ASTM C150, Type II

B. Coarse Aggregates:

1. ASTM C33
2. Graded 1 inch to No. 4 sieve

C. Sand:

1. ASTM C33
2. Fineness Modulus: 2.35

D. Water:

1. Potable.

2. Clean and free of injurious amounts of acids, alkalis, salts, organic materials, and substances incompatible with concrete or steel.

E. Air-Entraining Admixtures: ASTM C260

F. Reinforcing Steel:

1. Deformed Bars: ASTM A615, Grade 40 minimum
2. Welded Wire Fabric: ASTM A185

G. Gaskets:

1. Rubber gaskets: ASTM C443

H. Joint Sealant:

1. ASTM C990

I. Bedding:

1. Aggregate Bedding Material: Fill Type A1 as specified in Section 31 05 16, Aggregates for Earthwork. Size as shown in the Drawings.

2.6 FABRICATION

A. Fabricate precast reinforced concrete structures according to ASTM C913, to dimensions indicated on Drawings, and to specified design criteria.

B. Vaults may be formed with separate top and bottom slabs.

C. Walls shall be cast so that all sides are continuous at corners and their full length with no block-outs or knockouts.

D. Horizontal joints may be provided so that walls can be placed in horizontal segments.

E. All horizontal joints shall be keyed to prevent offsets and shall be provided with a watertight gasket.

F. Finish:

1. Formed surfaces shall be smooth and uniform with no fins, bulges, or other irregularities.

2. Any void greater in width than 1/2-inch or deeper than 3/8-inch shall be repaired.

3. Unformed interior slab surfaces shall have a smooth steel trowel finish.

4. Unformed exterior slab surfaces shall have a light broom finish applied to a steel trowel finish.

2.7 MIXES

A. Design concrete mix to produce required concrete strength, air-entrainment, watertight properties, and loading requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping connections, sizes, locations, and inverts are as indicated on Drawings.

3.2 PREPARATION

A. Ream pipe ends and remove burrs.

B. Remove scale and dirt from components before assembly.

C. Establish invert elevations for each component in system.

D. Hand trim excavation to suit valve vaults and meter boxes; remove stones, roots, and other obstructions.

3.3 INSTALLATION

A. Vaults/Meter and Bedding:

1. Excavate as specified in Section 31 23 16, Excavation for Work of this Section.

2. Hand trim excavation for accurate placement of vaults and meter boxes to elevations indicated.

3. Place bedding material level in one continuous layer to a minimum compacted depth of 6 inches.

4. Compact bedding material to 95 percent maximum density.

5. Bases for precast concrete structures shall be set level so that bedding material fully and uniformly supports them in true alignment with uniform bearing throughout full perimeter. Do not level bases by wedging gravel under the edges.

6. Backfill around sides of vaults and meter boxes as required by the Drawings.

B. Connect piping.

3.4 FIELD QUALITY CONTROL

A. Request examination of subgrade by Engineer prior to placing aggregate base under precast materials.

B. Compaction Testing: In accordance with Field Quality Control requirements of Section 31 23 23, Fill.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

D. Frequency of Compaction Tests: In accordance with Section 01 45 00, Quality Control.

END OF SECTION

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SECTION 33 11 50 - EXISTING PIPE ABANDONMENT

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the removal of existing buried piping and abandonment in place of existing buried piping.

B. Section includes:

1. Pipe removal.
2. In-place abandonment of pipe.

1.2 RELATED SECTIONS

A. Section 03 60 00 Grouting.
B. Section 31 23 16 Excavation.
C. Section 31 23 17 Trenching.
D. Section 31 23 23 Fill.
E. Section 31 23 24 Flowable Fill.

1.3 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00, Submittal Procedures.

B. Piping Abandonment Plan:

1. Identify locations specified for pipe abandonment.

2. Provide method to be utilized to abandon the pipe, including whether the pipe will be left in place or removed in its entirety.

C. Non-Shrink Grout: Product data in accordance with Section, 03 60 00 Grouting.

D. Controlled low-strength material (CLSM): Mix designs in accordance with Submittal requirements of Section, 31 23 24 Flowable Fill.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. Permits: The CONTRACTOR is responsible for obtaining all necessary permits required for completion of the WORK described herein.

B. Protection of Persons and Property: Meet all federal, state, and local safety requirements for the protection of workmen, other persons, and property in the vicinity of the WORK and requirements of the General Provisions.

1.5 PROTECTION OF EXISTING WORK

A. Carefully examine the Contract Documents to determine the extent of the WORK of this Section.

B. Carefully coordinate the WORK of this Section with all other WORK and construction.

C. Take all necessary precautions to prevent damage to existing facilities or utilities which are to remain in place and be responsible for any damages to existing facilities or utilities, which are caused by the operations.

1.6 REPAIR OF DAMAGE

A. WORK procedures shall provide for safe conduct of the WORK; careful removal and disposition of materials and equipment; protection of facilities, utilities and property which are to remain undisturbed; coordination with existing facilities and utilities to remain in service.

B. Any damage to existing facilities or utilities to remain as caused by the CONTRACTOR's operations shall be repaired to acceptance of ENGINEER.

C. Damaged items shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of WORK of this contract.

1.7 EXISTING CONDITIONS

A. If the pipe material contains any hazardous materials, such as asbestos, requiring special handling upon removal, it is the responsibility of the CONTRACTOR to remove and dispose of the material in accordance with all applicable federal, state, and local regulations.

PART 2 PRODUCTS

2.1 OWNERSHIP OF EXISTING MATERIALS

A. All materials, equipment, miscellaneous items and debris involved, occurring or resulting from pipe removal work shall become the property of the CONTRACTOR at the place of origin, unless otherwise specified in the DRAWINGS or by the ENGINEER.

2.2 CONTROLLED LOW STRENGTH MATERIAL

A. As specified in Section 31 23 24, Flowable Fill.

PART 3 EXECUTION

3.1 PIPE REMOVAL

A. Where identified on the DRAWINGS, remove and dispose of all pipe material and associated appurtenances.

1. All fire hydrants, air release valves service lines and appurtenances being abandoned shall be removed to 36 inches below finished grade.

2. Existing service line appurtenances, including valve and meter boxes, shall be removed to 36 inches below finished grade.

B. All exposed ends of pipes and fittings to remain in service shall be capped or plugged with an appropriate ductile iron blind flange, cap or plug and restrained.

1. A pipe shall be considered in service if it is possible to flood the pipe with water by opening valves in the water system.

C. All excavation and backfilling associated with pipe removal shall be performed in accordance with 31 23 17, Trenching.

3.2 IN-PLACE ABANDONMENT OF PIPING

A. Where identified on the DRAWINGS, abandon pipe in place.

B. All exposed ends of pipes being abandoned in place shall be cut and plugged with a minimum of 2 feet of non-shrink grout.

C. Prior to placing grout, roughen interior pipe surface and apply epoxy bonding agent.

3.3 FILLING PIPE WITH CLSM

A. Where identified on the Plans, pipes greater than 12 inches in diameter to be abandoned-in-place shall be filled with CLSM.

B. CLSM shall be placed in a manner to ensure complete filling of the pipe, leaving no cavities or voids.

C. Install hot taps, saddles, fill lines, and appurtenances as necessary for pumping CLSM from the surface into the pipe being filled.

D. CLSM shall be pumped up grade from fill lines rigidly connected to the pipes being filled.

E. Placement of CLSM by free flowing (non-pumped) methods will not be acceptable.

F. Fill lines shall be located at elevations lower than the pipe being filled.

G. As the CLSM is being placed, use other fill lines as view ports to ensure complete filling of the pipes.

H. Relocate pumping equipment as necessary to complete filling of the pipes.

I. Excavate and cut access holes in the pipes as necessary to complete filling operations.

J. Perform pipe filling operations in a manner to eliminate all air pockets.

K. Submit volume calculations for CLSM placed in each filled segment of piping to verify that pipelines have been completely filled.

3.4 CLEANUP

A. During and upon completion of WORK of this Section, promptly remove all unused tools and equipment, surplus materials and debris.

B. Adjacent areas shall be returned to their existing condition prior to the start of WORK.

END OF SECTION

SECTION 33 13 00 - TESTING OF UTILITY PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes hydrostatic pressure testing of utility systems piping, fittings, and valves.

B. Section Includes:

1. Pressure testing of transmission piping systems and appurtenances.
2. Testing and reporting of results.

C. Related Requirements:

1. Section 33 31 10 – Sanitary Utility Sewerage Piping

1.2 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

1. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

1.3 SUBMITTALS

A. Section 01 33 00 –Submittals Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Pipeline Testing and Disinfection Plan: To be submitted for review and approval by the Engineer a minimum of 1 month before testing is to start. As a minimum, the plan shall include the following:

1. Testing schedule.

2. Hydrostatic Testing Plan:

   a. Narrative of the proposed process.
   b. Proposed equipment to be used.
   c. Disposal location for excess water used to fill mains.

3. Proposed testing locations.

4. Proposed plan for water conveyance, including flow rates.

5. Proposed plan for water control.

6. Proposed plan for water disposal, including flow rates.

7. Proposed measures to be incorporated in the project to minimize erosion while discharging water from the pipeline.

1.4 QUALITY ASSURANCE

A. Perform Work according to AWWA C651.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. All test equipment, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor subject to the Engineer's review. No materials shall be used which would be injurious to the construction or its future functions.

B. All temporary thrust restraint and equipment and facilities required for hydrostatic testing will be considered incidental.

C. As a minimum, furnish the following equipment and materials for the testing:

Amount	Description
2	Graduated containers approved by the Engineer.
1	Hydraulic pump approved by the Engineer with hoses, valves, and fittings as needed and required for the testing and disinfection of the facilities.
2	Pressure gauges with pressure range at least 120 percent greater than the required maximum test pressure with graduations in 2 pounds per square inch (psi) increments. Gauges shall have been calibrated with 90 days of pressure testing.

PART 3 EXECUTION

3.1 HYDROSTATIC TESTING OF UTILITY PIPING

A. Make all necessary provisions for conveying water to the points of use and for the disposal of test water.

B. No section of the pipeline shall be hydrostatically tested until backfill has been placed, compacted, and passed required density testing and all field-placed concrete or mortar has attained full strength.

1. At the Contractor's option, early strength concrete may be used when the full-strength requirements conflict with schedule requirements.

2. All such substitutions and installations shall be approved by the Engineer prior to installation.

C. Provide 72-hour notification to the Engineer and Owner prior to conducting hydrostatic testing.

1. Provide coordination and scheduling required for the Owner and Engineer to witness and provide necessary labor for operating Owner's existing system during hydrostatic testing and disinfecting procedures.

2. The Contractor shall not operate any part of the existing water systems.

D. Pipe Filling:

1. Fill pipes slowly from the lowest elevation to highest point along test section with potable water.

2. Take all required precautions to prevent entrapping air in the pipes.

3. Allow for natural absorption of water by the lining of the pipe to occur.

4. Apply specified test pressure by pumping.

E. Testing of Force Mains:

1. Ductile Iron: In accordance with AWWA C600.

2. Polyvinyl chloride (PVC): In accordance with AWWA C605.

3. General:

a. Tests shall be conducted under a hydrostatic test pressure not less than 1.25 times the stated anticipated maximum sustained working pressure of the pipeline measured at the highest elevation along the test section and not less than 1.5 times the stated working pressure at the lowest elevation of the test section, minimum 100 psi, unless otherwise shown in the Drawings.

b. In no case shall the test pressure exceed the rated working pressure for any joint, thrust restraint, valve, fitting, or other connected appurtenance of the test section.

c. Testing shall be performed by applying the specified test pressure by pumping.

d. Once the test pressure has been attained, the pump shall be valved off.

e. The test will be conducted for a 2-hour period with the allowable leakage not to exceed the value as calculated per the Allowable Leakage formula below.

f. During the test period, there shall be no appreciable or abrupt loss in pressure.

4. Allowable Leakage:

a. Flanged Joints: Pipe, fittings, and valves with flanged joints shall be completely watertight. No leakage allowed.

b. Mechanical or Push-on Joints: Pipe, fittings and valves with rubber gasketed joints shall have a measured loss not to exceed the rate given in the following Allowable Leakage formula:

$$AL = \frac{LD(P)^{1/2}}{148{,}000}$$

In the above formula:

AL = Allowable leakage, in gallons per hour
L = Length of pipe tested, in feet

D = Nominal diameter of pipe, in inches
P = Average test pressure during the leakage test, in pounds per square inch.

5. Maintaining Pressure:

   a. During the test period, operate the pump as required to maintain pressure in the pipe within 5 psi of the specified test pressure at all times.

   b. At the end of test period, operate the pump until the specified test pressure is again obtained.

      1) The pump suction shall be in a clean, graduated barrel, or similar device or metered so that the amount of water required to restore the test pressure may be accurately measured.

      2) Sterilize this makeup water by adding chlorine to a concentration of 25 milligrams per liter (mg/L).

   c. The Engineer will determine the quantity of water required to maintain and restore the required pressure at the end of the test period.

   d. Each hour's loss stands on its own and will not be averaged.

6. Defects, Leakage, Failure:

   a. If the test reveals any defects, leakage in excess of the allowable, or failure, furnish all labor, equipment, and materials required to locate and make necessary repairs.

   b. Correct any visible leakage regardless of the allowable leakage specified above.

   c. All leaks shall be repaired in a manner acceptable to the Engineer.

   d. The testing of the line shall be repeated until a test satisfactory to the Engineer has been achieved.

3.2 TESTING OF UTILITY END CONNECTIONS AND TIE-INS

A. Connection of the new piping and appurtenances to the existing system shall be made and checked for leakage:

1. During the system startup, the Engineer and Contractor shall visually inspect all new fittings, piping, valves and appurtenances for evidence of leakage.

2. Any leakage observed during this period shall be promptly repaired by the Contractor, at Contractor's expense, as required by the Engineer.

END OF SECTION

SECTION 33 31 10 - SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes pipe materials, manholes, and accessories normally used with gravity sanitary sewers and sanitary force mains.

B. Section includes:

1. Sanitary sewerage pipe and fittings.
2. Pipe markers.
3. Connection to existing manholes.
4. Manholes.
5. Wye branches and tees.
6. Sanitary laterals.
7. Bedding and cover materials.

1.2 RELATED SECTIONS

A. Section 03 11 00 – Concrete Work

B. Section 03 60 00 - Grouting

C. Section 09 90 00 – Painting and Coating

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. ASTM International (ASTM):

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

5. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

6. ASTM C1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.

7. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

8. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

9. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

10. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

11. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

12. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

13. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

14. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

15. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

16. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

17. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

C. American Water Works Association (AWWA):

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.

4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.

6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.

7. AWWA C153 - Ductile-Iron Compact Fittings.

8. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

1.4 COORDINATION

A. Notify affected utility companies at least 72 hours prior to construction.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer catalog cuts and other information indicating proposed materials, accessories, details, and construction information.

B. Shop Drawings:

1. Indicate layout of sewer system and appurtenances.

2. Show size, materials, components of system, and burial depth.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. The certificate shall be signed by an authorized agent of the manufacturer.

D. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.

E. Manufacturer Instructions:

1. Indicate special procedures required to install specified products.
2. Submit detailed description of procedures for connecting new sewer to existing sewer line.

F. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections, manholes, and cleanouts.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Materials:

1. Unless otherwise noted, all water works materials provided for the project shall be new, of first-class quality and shall be made by reputable manufacturers.

2. All material of a like kind shall be provided from a single manufacturer unless otherwise approved by the OWNER’s Representative.

3. All material shall be carefully handled and installed in good working order free from defect in manufacture, storage, and handling.

4. All pipe and fittings shall be manufactured in the United States of America, unless otherwise approved by the OWNER.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer’s original packaging and inspect for damage.

B. Storage:

1. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture, dust, and direct sunlight by storing in clean, dry location remote from construction operations areas.

2. Block individual and stockpiled pipe lengths to prevent moving.

3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 SANITARY SEWERAGE PIPE AND FITTINGS

A. Plastic Pipe:

1. Material:

a. Polyvinyl chloride (PVC), manufactured from rigid polyvinyl chloride compounds conforming to ASTM D1784, Class 12454-B.

b. At locations indicated in the Drawings, pipe shall conform to AWWA C900.

2. Fittings: PVC.

3. Pipe and fittings 4 inches to 15 inches in diameter:

a. Comply with ASTM D3034, SDR 35.

4. Pipe and fittings 18 inches and larger in diameter:

a. Comply with ASTM F679, PS46.
b. Pipe shall have a minimum stiffness of 46 pounds per square inch (psi).

5. AWWA C900 Pipe:

a. 4 inches to 12 inches in diameter.
b. DR 25.
c. Pipe shall have minimum stiffness of 149 psi.

6. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint.

7. Joints:

    a. Integral bell push-on type: Comply with ASTM D3212.
    b. For use with AWWA C900 pipe: Integral bell push-on type: Comply with ASTM D3139.

8. Gaskets:

    a. Factory installed.
    b. Elastomeric gaskets: Comply with ASTM F477.

B. Ductile-Iron Pipe:

1. Comply with AWWA C151.

2. Minimum Special Thickness Class: 52.

    a. Class 53 for flanged pipe as specified herein.

3. End Connections: Bell and spigot or plain, and as shown in the Drawings.

4. Outside Coating (buried):

    a. Type: Asphaltic coating, minimum 1 mil uniform thickness.
    b. Comply with AWWA C151.

5. Outside Coating (exposed):

    a. Shop primed with coating meeting requirements of Section 09 90 00 Painting and Coating.

6. Lining (Pipe and Fittings):

    a. Standard coating from pipe manufacturer.

7. Polyethylene encasement:

    a. Comply with AWWA C105.

    b. Polyethylene film shall be minimum 8-mil thick virgin linear low-density polyethylene (LLDPE).

8. Fittings:

    a. Material: Ductile iron.

    b. Comply with AWWA C153 or AWWA C110.

    c. Lining: Protecto 401 Ceramic Epoxy Lining.

    d. Coating: Meeting requirements of the adjacent ductile iron pipe.

    e. Fittings shall be mechanical joint, push-on type, flanged or plain-end as required and shown on the Drawings.

f. All ductile-iron fittings and fitting joint restraints shall be wrapped in the field as follows:

1) Petroleum wax tape coating system:

a) Apply a wax tape coating system generally per AWWA C217 and consisting of three parts: surface primer, wax-tape, and outer covering. All three parts shall be the product of the same manufacturer.

b) The primer shall be a blend of petrolatum, plasticizer, and corrosion inhibitors having a paste-like consistency. It shall have a pour point of 100-degrees F to 110-degrees F and a flash point of 350-degrees. Use Trenton Wax-Tape Primer or approved equal.

c) The wax-tape shall consist of a synthetic-fiber felt, saturated with a blend of high-melt microcrystalline wax, solvents, and corrosion inhibitors, forming a tape coating that is easily formable over irregular surfaces and which firms up after application. The tape shall have a saturant pour point between 125-degrees F and 130-degrees F and a dielectric strength equal to a minimum of 100-volts per mil. Tape thickness shall be 50-mils to 90-mils in 6-inch wide rolls. Use Trenton No. 1 wax-tape or approved equal.

d) The outer covering shall consist of two layers of a plastic wrapper at total of one 150-gauge or three 50-gauge wound together as a single sheet. The plastic wrapper material shall consist of clear polyvinylidene chloride, high-cling membranes wound together as a single sheet. Use Trenton Poly-Ply or approved equal.

9. All restraint systems and flanged fittings shall be provided with bolts and gaskets as specified herein.

10. Joints:

a. Joint types shall be provided as identified in the Drawings and as required for the application.

b. Mechanical Joints:

1) Comply with AWWA C111.

c. Push-on Joints:

1) Comply with AWWA C111.

2) Manufacturers, without exception:

a) Tyton Joint by American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, McWane, and Pacific States Cast Iron Pipe.

b) Fastite Joint by American Cast Iron Pipe Company.

d. Restrained Joints:

1) Joint restraint for pipe shall be accomplished with an integral lock mechanism, except as may be otherwise specified.

a) Any such system shall be a manufacturer's standard proprietary design, shall be as recommended by the manufacturer for the application, and shall be performance proven.

2) Restraining components:

a) Ductile iron complying with AWWA C110 and/or C153, with the exception of a manufacturer's proprietary design dimensions.

b) Push-on joints for such fittings shall comply with AWWA C111.

3) Deflection:

a) The maximum pipe deflection shall not exceed one half of the manufacturer's stated joint deflection allowance.

4) Manufacturers:

a) "Fast Grip", American Cast Iron Pipe Company.

b) "Field-Lok", United States Pipe and Foundry Company.

c) "MEGALUG", EBAA Iron, Inc.

(1) Where any restrained joint system requires the use of a wedge-type mechanical restraint gland for restraint, the glands shall be provided in quantities as may be required and shall be considered incidental to the joint restraint system.

(2) Wedge-type mechanical restraining glands shall not be used to restrain the plain end of plain end ductile iron or cast iron fittings.

d) Approved equal.

e. Flanged Joints:

1) Flat faced, complying with AWWA C115.

2) Bolt hole drilling according to ASME/ANSI B16.1, Class 125. Flanges shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown.

3) The CONTRACTOR shall coordinate with pipe, valve and fitting suppliers to make certain mating pipe, valve and fitting flanges match in bolt pattern.

4) AWWA flanges shall not be exposed to test pressures greater than 125% of rated capacity.

5) Threaded flanges:

a) Ductile iron pipe spools with threaded flanges shall conform to AWWA C115.
b) Installed only on pipe with a minimum Class 53 wall thickness.

6) Buried flanges:

a) Flanged connections shall not be buried unless shown as such on the Drawings.

b) Buried flanges shall be wrapped with 2 layers of 10 mil tape along edges of flanges.

7) Gaskets:

a) Full faced, composed of synthetic rubber and 1/8-inch thick conforming to ASME B21.1 and AWWA C111.

b) Ring gaskets will be permitted only where specifically noted in the Drawings and Specifications.

c) Gaskets for flanged joints shall be as follows:

(1) All pipe sizes with service pressures of 150 psi or less shall be Garlock 98206 or equal.

d) Flanged insulating joints shall be as specified in section 40 05 13-Common Work Results for Process Piping.

2.2 FLEXIBLE COUPLINGS

A. Description:

1. Resilient chemical-resistant elastomeric polyvinyl chloride (PVC) coupling.
2. Attachment: Two [Series 300] stainless-steel clamps, screws, and housings.

2.3 MIXES

A. Grout: As specified in Section 03 60 00, Grouting.

PART 3 EXECUTION

3.1 INSTALLATION

A. Piping:

1. Install pipe, fittings, and accessories according to standards listed below, and seal joints watertight.

a. PVC: Comply with ASTM D2321.
b. Ductile Iron: Comply with AWWA C600.

2. Lift or roll pipe into position.

3. Lay pipe to slope gradients and line as indicated on Drawings.

4. Variations:

   a. Maximum Variation from Indicated Line: 1/32-inch per inch of pipe diameter, but no more than 1/2-inch, providing that such variation does not result in a level or reverse-sloping invert.

   b. Maximum Variation from Indicated Grade: 1/32-inch per inch of pipe diameter, but no more than1/4-inch.

   c. Variation in the invert elevation between adjoining ends of pipe, include fittings, shall not exceed 1/64-inch per inch of pipe diameter, or 1/2-inch maximum.

5. Begin at downstream end and progress upstream.

6. Assemble and handle pipe according to manufacturer's instructions, except as may be modified on Drawings or by ENGINEER.

7. Make straight field cuts without chipping or cracking pipe.

8. Keep pipe and fittings clean until WORK has been completed and accepted by ENGINEER.

9. Assemble pipe joints in accordance with manufacturer's recommendations/specifications.

10. Cap open ends during periods of WORK stoppage.

B. Wye Branches and Tees:

1. Concurrent with pipe-laying operations, install wye branches and pipe tees at locations indicated on Drawings.

2. Use standard fittings of same material and joint type as sewer main.

3. Use saddle wye or tee with stainless-steel clamps for taps into existing piping.

4. Mount saddles with solvent cement or gasket and secure with metal bands.

5. Lay out holes with template and cut holes with mechanical cutter.

3.2 TESTING

A. CONTRACTOR to perform visual inspection of all replacement piping shown during startup of the instrumentation and controls.

END OF SECTION

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SECTION 40 05 13 - COMMON WORK RESULTS FOR PROCESS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section applies to the furnishing and installation of piping inside a building, structure, enclosure piping and miscellaneous yard piping.

B. Section Includes:

1. Process piping, fittings, and appurtenances
2. Plumbing materials and appurtenances
3. Pipe supports
4. Penetrations, sleeves, and seals

1.2 RELATED SECTIONS

A. Section 03 11 00 – Concrete Work
B. Section 05 50 00 – Metal Fabrications
C. Section 09 90 00 – Painting and Coating
D. Section 31 23 16 – Excavation
E. Section 31 23 17 – Trenching
F. Section 33 13 00 – Testing & Disinfecting of Utility Piping – Not Used
G. Section 40 05 51 – Common Requirement Results for Process Valves

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B1.20.1 Pipe Threads, General Purpose (inch)
2. ASME A13.1 - Scheme for the Identification of Piping Systems.
3. ASME B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys
4. ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
5. ASME B31.3 - Process Piping.
6. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile.

3. ASTM A325 - Specification for High-Strength Bolts for Structural Steel Joints.

4. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

5. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

6. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

7. ASTM D792 - Test Methods for Specific Gravity and Density of Plastics by Displacement.
8. ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
9. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
10. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
11. ASTM D2000 - Classification System for Rubber Products in Automotive Applications.
12. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
14. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

C. American Water Works Association:

1. AWWA C200 - Steel Water Pipe - 6 In. (150 mm) and Larger.
2. AWWA C207 - Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.
3. AWWA C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe.
4. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
5. AWWA C510 - Double Check Valve Backflow Prevention Assembly.
6. AWWA C511 - Reduced-Pressure Principle Backflow Prevention Assembly.
7. AWWA C606 - Grooved and Shouldered Joints.
8. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

D. American Welding Society:

1. AWS D1.1 - Structural Welding Code.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

F. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.4 COORDINATION

A. Coordinate installation of specified items with installation of valves and equipment.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit manufacturer catalog information for each product specified.

C. Shop Drawings:

1. Identification:

a. Submit list of wording, symbols, letter size, and color coding for pipe identification.
b. Comply with ASME A13.1.

2. Provide all necessary dimensions and details on pipe joints, restraints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists.

3. Provide detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, couplings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

D. Manufacturer's Statement: Certifying pipe fabrication and products meet or exceed specified requirements.

E. Welder Certificates: Certify welders and welding procedures employed on WORK, verifying AWS and ASME qualification within previous 12 months.

F. Manufacturer Instructions: Submit special procedures and setting dimensions.

G. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

H. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping appurtenances.
B. Identify and describe unexpected variations to pipe routing or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Drawings:

1. Piping layouts shown in the DRAWINGS are intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the CONTRACTOR's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

B. Inspection:

1. All pipe shall be subject to inspection at the place of manufacture.

2. During the manufacture of the pipe, the ENGINEER shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the SPECIFICATIONS.

C. Welding:

1. All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1.

2. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

D. Welders:

1. Skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used shall do all welding.

2. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local approved testing agency prior to commencing WORK on the pipeline.

3. Machines and electrodes similar to those used in the WORK shall be used in qualification tests.

4. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

E. Tests: Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards. Welds shall be tested as specified. The CONTRACTOR shall perform all tests at no additional cost to the OWNER.

1.8 MATERIAL DELIVERY, STORAGE AND INSPECTION

A. Inspection:

1. Accept materials on Site in manufacturer's original packaging and inspect for damage.

2. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition.

B. Storage:

1. Store materials according to manufacturer instructions.

2. Store materials off the ground, to provide protection against oxidation caused by ground contact

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.

3. Provide additional protection according to manufacturer instructions.

D. All defective or damaged materials shall be replaced with new materials.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the "lead free" requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for "lead free".

2. All brass in contact with potable water shall comply with ASTM B584.

B. Unless specified otherwise or indicated differently in the DRAWINGS, all process piping systems and materials shall be as listed in the table below or as shown on the DRAWINGS:

Service Designation	Material
Storm Drainage/Sanitary Sewer (Gravity)	See Section 33 31 10
Sanitary Sewer Force Main > 4" (Exposed)	Class 52 Ductile Iron, or Class 53 where specified
Sanitary Sewer Force Main > 4" (Buried)	Class 52 Ductile Iron
Sanitary Sewer Force Main < 4"	Stainless Steel - Type 316 Schedule 40 Threaded - ASTM A 312 Fittings Welded or Threaded
City Water / Non-potable water / Water Service	Copper Tubing - ASTM B88 Type K or Type L Soft / Fittings - Wrought Copper - ANSI B16.22, Joints-Soldered
Storm Drainage/Sanitary Sewer	See Division 33.
Miscellaneous Pipelines	As shown in the DRAWINGS

2.2 FLANGED DUCTILE IRON PIPE AND FITTINGS

A. Per specification 33 31 10 Sanitary Utility Sewerage Piping

2.3 COPPER PIPE AND FITTINGS

A. Description:

1. Seamless; ASTM B88.

2. Type:

a. Type L, hard drawn.

b. For pipe under floor slabs, underground or cast in concrete: Type K, annealed, seamless.

B. Joints:

1. Compression.
2. Manufacturer: Mueller Model 110 or approved equal

C. Dissimilar Metals: See Dielectric Unions specified herein.

2.4 BRASS PIPE AND FITTINGS

A. Pipe: ASTM B43, chrome plated.

B. Fittings:

1. ASTM B584, brass.
2. ASTM B16.15.

C. Joints:

1. Mechanical compression.
2. Threaded: Tapered and smooth threads, ASME B1.20.1 and ASTM B43.

D. Dissimilar Metals: See Dielectric Unions specified herein.

2.5 FLEXIBLE TUBING

A. Crosslinked Polyethylene (PEX) tubing:

1. Standard weight, conforming to ASTM F876.

2.6 STEEL PIPE AND FITTINGS

A. Pipe: Seamless, conforms to and tested per AWWA C200, shop lining and coating per applicable AWWA standard.

B. Material and Pipe Requirements

1. 20” Steel Replacement Piping:

a. Electrically butt-joint welded spiral-seam pipe manufactured from ASTM A-139, Grade B steel (or better), or approved equal. Steel materials and shop welding for manufacturing piping shall be per the requirements of AWWA C200;

b. Inside-diameter (ID) pipe per AWWA C200, with minimum steel can thickness of 5/16”;

c. Furnished with ends prepared for butt strap connections per project plans;

d. 20" steel replacement piping shall be shop cement-mortar lined and coated per the requirements of AWWA C205, with holdbacks as required per project plans.

2. Flanges, Flanges Spools, and Appurtenances

a. Steel flanges shall be ring style/slip-on or blind flange as shown on Plans, Class D, attached via welding and tested in the shop as required, and with material properties and dimensions all per the requirements AWWA C207. Flanges shall also be epoxy coated and lined per AWWA C210 and as specified herein.

b. Bolting Materials – Bolts for AWWA C207 steel pipe flanges shall be ASTM A193 grade B7 with ASTM A194 grade 2H heavy hex nuts. Bolts shall have regular unfinished square or hexagonal heads, and nuts shall have regular square or hexagonal dimensions, all in accordance with ANSI B18.2.1 for wrench head bolts and nuts and wrench openings. Washers shall conform to the specifications of ASTM F436. For underground piping, fittings and valves all nuts and bolts shall be hot dip galvanized per ASTM F2329. Bolting materials shall have product marking in accordance with ASTM A193 and ASTM A962.

c. Gaskets for buried flanged steel pipe shall be full faced gaskets equal to Garlock 98206, or an approved equal.

d. Gaskets must be rated for the maximum working pressures for each piping system. Where mating flanges have different inside diameters, furnish gasket with an inside diameter to match the larger flange inside diameter.

e. Steel flange spools shall be fabricated in the shop with flanges as specified above, plain end steel pipe per ASTM A53, or approved equal, with standard Schedule 40 thickness, and coated and lined with epoxy per AWWA C210 and as specified herein.

3. Butt Straps – Butt strap joints shall be used where shown on Plans. The joints furnished shall have the same or higher pressure rating as the abutting pipe. Butt strap steel shall be compatible for fillet welding to piping being furnished and existing piping. Each joint shall have a th4readed tap suitable for air testing between the two welds. Once the joints has been successfully tested, the tap shall be plug welded. Buttstrap joints shall be welded inside and outside the two taps (4 total air taps for two-piece buttstrap) for air testing.

4. Epoxy Lining and Coating for Specials: All epoxy lining and coating systems shall conform to AWWA C210, and shall be as follows:

a. Liquid Epoxy (AWWA C210)
b. Location – Ferrous surfaces of steel pipe and fabricated specials.
c. Surface Preparation – As recommended by the coating manufacturer

GALVANIZED STEEL PIPE AND FITTINGS

C. Pipe: Seamless, or electric resistance welded, ASTM A53, Schedule 40.

D. Joints: Threaded.

E. Fittings:

1. Threaded, 150 lb. malleable iron, galvanized, ASTM A197 or ASTM A47, dimensions conforming to ANSI B16.3.

2. Unions, 300 lb. malleable iron, galvanized with dimensions conforming to ANSI B16.3, brass to iron seat.

3. Thread lubricant shall be Teflon tape or joint compound that is insoluble in water.

F. Buried Service:

1. Galvanized pipes shall be spirally wrapped with polyvinyl chloride or polyethylene pressure sensitive tape, applied with a suitable primer.

2. The wrap shall have a nominal thickness of 20 mils, consisting of either one layer of 20-mil tape or two separate layers of 10-mil tape.

3. Before the primer and wrap is applied, the piping shall be thoroughly cleaned so that all surfaces shall be dry and free of dirt, dust, rust, oil scale, oil, grease, or other foreign matter.

4. Any solvents used shall be totally volatile so as to leave no trace of oil.

5. Weld spatters, burrs, or sharp points and edges shall be removed by chiseling, ball peening or filling.

6. After thorough cleaning, the piping shall be coated with a primer applied in accordance with the tape manufacturer's recommendations. Spiral wrappings shall be applied with an overlap of at least 1-inch.

2.7 STAINLESS STEEL TUBING AND FITTINGS

A. Type 316 stainless steel, unless otherwise specified or shown in the Plans.

B. Meet the material standards set forth in ASTM A269.

C. Fittings: ASTM A276 and ASTM A182.

1. Threaded fittings: National pipe thread meeting the requirements of ASME B1.20.1.
2. Compression fittings: Two-ferrule, mechanical grip design.

D. Unions: Provide to facilitate installation and maintenance of tubing.

E. Manufacturer:

1. Swagelock, or approved equal.

2.8 STAINLESS STEEL PIPE AND FITTINGS

A. Pipe:

1. Size: 4 inches and smaller, schedule 80, type 304, unless otherwise specified.
2. Conforming to ASME B36.19 dimensions.
3. Conforming to ASTM A312 material requirements.

B. Fittings: Conform to ASME B16.11 dimensions and ASTM A182 material requirements.

C. Threads: Conform to ASME B1.20.1.

D. Socket welds: Conform to ASME B16.11.

2.9 FLEXIBLE COUPLINGS

A. Description:

1. Sleeve-type, couplings. Comply with AWWA C219.

2. Minimum design pressure rating: 150 psi.

3. Middle Ring: As required for coupling based upon connecting pipe materials, steel or ASTM A536, ductile iron.

4. Followers: As required for coupling based upon connecting pipe materials, steel or ASTM A536, ductile iron.

5. Gaskets:

a. Material: Buna-N.
b. Comply with ASTM D2000.

6. Bolts:

a. Buried: Steel.
b. Submerged: Stainless steel.

7. Center Pipe Stop: Required where shown on the DRAWINGS.

B. Finishes:

1. Buried Couplings, Bolts: Factory epoxy coated.

C. Manufacturers:

1. For ductile iron and steel pipe:

a. Dresser, Style 38.
b. Romac, Model 501.
c. Smith-Blair.

2. For PVC pipe:

a. Romac, Model 501 or approved equal.

3. For flanged steel and ductile pipe:

a. Dresser, Style 128 or approved equal.

2.10 RESTRAINED FLANGED COUPLING ADAPTERS

A. Description:

1. ASTM A536, ductile iron.

2. Flange bolt circles compatible with ANSI/AWWA C115/A21.15.

3. Restraint for the flange adapter shall consist of a plurality of individually actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of the gripping wedges.

4. Capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6-inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

5. Safety factor of 2:1 minimum.

6. Manufacturer:

a. EBAA Iron, Series 2100 Megaflange or approved equal.

2.11 FLANGED INSULATING JOINTS

A. Set shall include a full faced gasket, a full length insulating sleeve for each flange bolt, and two insulating washers and two steel washers for each bolt.

1. Gaskets:

a. Full face, comply with ASME 16.21.
b. Non-asbestos and non-phenolic compressed sheet packing with nitrile rubber binder.
c. Manufacturer: Garlock, Style 3505, or equal.

2. Insulating sleeves:

a. G-10 glass epoxy.

b. Extend the full width of both flanges, except where one flange hole is threaded where the sleeve shall extend through one flange and the gasket.

3. Insulating washers:

a. G-10 glass epoxy.
b. 1/8-inch thickness.

4. Washers:

a. Buried: Cadmium plated steel.
b. Submerged: Stainless steel.

B. The complete assembly shall have an ANSI/AWWA pressure rating equal to or greater than that of the flanges between which is installed.

C. After assembly, the joint shall be tested for continuity. Electrical resistance between flanges and between each bolt and each flange shall be not less than 100,000 ohms.

2.12 INSULATING UNION

A. Description:

1. Material: Galvanized malleable iron with a ground joint.

2. Iron pipe threads: Conform to ANSI B2.1.

3. Insulations: Nylon, bonded and molded onto the metal body.

4. Union: Rated for the operating and test pressures of the pipe system.

5. Joint connections to copper alloy pipe and tube shall be copper solder or threaded brass ground joints.

6. Isolation Barrier: Impervious to water.

2.13 DISMANTLING JOINT

A. Description:

1. Comply with AWWA C219, where applicable.

2. Self-contained flanged restrained joint fitting, including both flanged components and sufficient harness bars to withstand the imposed thrust.

3. Design: No part of the restraint system extends outside the flange diameter. The internal bore shall match that of the pipe system.

4. Dismantling joints will allow for a minimum of 2 inches of longitudinal adjustment.

5. Furnish as a complete assembly consisting of spigot piece, flange adaptor, tie bars and gasket.

6. The gasket seal and compression stud and nut arrangement shall be independent of the tie rod restraint system. Tie Rod diameter shall be compatible with the corresponding bolt diameter of the mating flange. The Tie Rod restraint system shall be capable of withstanding the full pressure thrust that the pipe system can develop at no more than 50% of the yield strength of tie rod material.

7. Pressure Rating:

a. Determined by the flange configuration, and all commonly used flanges shall be available.

b. Design pressure rating shall be equal to or greater than the mating flanges.

c. Dismantling joints will be specially fabricated to accommodate pressure requirements with ANSI B16.5 or ANSI B16.47 300-pound class flanges, depending on size of dismantling joint.

8. Lining and Coating:

a. Shop-applied fusion bonded epoxy coating applied by fluidized bed method, complying with the requirements of NSF 61 and AWWA C550 as applicable.

b. As an alternative, a shop-coat primer suitable for field applied coatings can be supplied.

9. Flanges: Flat-faced, rated to pressure requirements as shown on the DRAWINGS.

a. Where design pressure is greater than 300 psi, flanges shall conform to ASME B16.5 and ASME B16.47 300-pound class.

B. Materials:

1. Spigot piece: Steel, ASTM A283 Grade C.

2. Flange adaptor:

a. Up to 12-inch diameter: Ductile iron, ASTM A536 Grade 65-45-12.
b. Above 12-inch diameter: Steel, ASTM A283 Grade C.

3. Tie bars: Stainless Steel.

4. Gasket: EPDM Grade E.

5. Nuts, Bolts and Washers: Type 316 stainless steel.

C. Manufacturer:

1. Romac or approved equal.

2.14 PIPE SUPPORTS

A. Floor Support for Pipe:

1. Flanged Pipe Support:

a. Construction:

1) Adjustable vertical pipe support, flange plate, extension pipe from base cup to top collar cup with threaded stud.

2) Bolts directly to flange.

3) Anchorable base plate.

b. Material: Stainless Steel

c. Manufacturers:

1) Standon - Model S89.

2. Cradle Pipe Support:

a. Construction:

1) Adjustable vertical pipe support with saddle strap, extension pipe from base cup to top collar cup with threaded stud.

2) Anchorable base plate.

b. Material: Stainless Steel

c. Manufacturers:

1) Standon - Model S92.

2.15 PIPE PENETRATIONS

A. Sleeves for Pipes through Walls and Floors:

1. Material: Galvanized steel.

2. Thickness: Schedule 40.

3. Inside surface of all wall sleeves shall be coated with coal-tar.

4. Annular space between penetrating pipe and wall sleeve shall be filled with an approved permanently flexible sealant.

5. Diameter of wall sleeve shall be as shown in the DRAWINGS.

B. Mechanical Sleeve Seals:

1. Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2. Manufacturer: Link-Seal or approved equal.

C. Pipes Cast-In Walls and Floors:

1. Material: Ductile iron or steel pipe, as required by the DRAWINGS and the intended service.
2. Diameter: As shown in the DRAWINGS.
3. End Type: As shown in the DRAWINGS.

D. Seep Rings:

1. Material: 3/8-inch thick steel plate conforming to ASTM A36, unless otherwise noted.

2. Inside diameter: Equal to the outside diameter of the pipe or sleeve to which it is attached plus 1/4-inch.

3. Outside diameter: As shown in the DRAWINGS.

4. Attach to the pipe or sleeve by means of a continuous seal weld located on both sides of the ring.

E. Pipe to Structure Flexible Connector

1. A flexible pipe to structure connector shall be used in the connection of sanitary and drain sewer pipe to wet wells, precast manholes, catch basins and buildings.

2. The connector shall be the sole element relied on to insure a flexible watertight seal of the pipe to the manhole. No adhesives or lubricants shall be employed in the installation of the connector to the manhole.

3. The rubber for the connector shall comply with ASTM C923 and consist of EPDM and elastomers designed to be resistant to ozone, weather elements, chemicals, including acids, alkalis, animal and vegetable fats, oils and petroleum products from spills.

4. All stainless steel elements of the connector shall be totally non-magnetic, Series 304 Stainless, excluding the worm screw for tightening the steel band around the pipe which shall be Series 305 Stainless. The worm screw for tightening the steel band shall be torqued by a break away torque wrench available from the precast manhole supplier and set for 60-70 inch/lbs.

5. The connector shall be installed in the structure wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer.

6. The connector shall be of a size specifically designed for the pipe material and size being utilized on the project.

7. The connector shall be Kor-N-Seal or approved equal.

2.16 PIPE COATINGS

A. See Section 09 90 00, Painting and Coating.

PART 3 EXECUTION

3.1 GENERAL

A. Furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.

B. Pipe shall be installed in accordance with good trade practice. The methods employed in handling and placing of pipe, fittings, and equipment shall be such as to ensure that after installation and testing they are in good condition. Should damage occur to the pipe, fitting or equipment, repairs satisfactory to the ENGINEER shall be made.

3.2 INSTALLATION

A. Interior Piping Systems:

1. Install non-conducting dielectric connections wherever joining dissimilar metals.

2. Establish elevations of buried piping outside valve vault to obtain not less than 3 feet of cover.

3. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting as specified in Section 09 90 00, Painting and Coating.

4. Install piping according to ASME B31.9.

5. Install unions downstream of valves and at equipment or apparatus connections.

6. Install brass male adapters each side of valves in copper piped system; solder adapters to pipe.

B. Pipe Supports and Hangers

1. Install pipe supports according to MSS SP-58 & ASME B31.10.

2. All pipe shall be secured in place by use of blocking, hangers, brackets, clamps or other approved methods, and the weight thereof shall be carried independently of pump casings or equipment.

3. Special hangers and supports are shown on the DRAWINGS.

4. The CONTRACTOR shall be responsible for determining the location of and providing all additional supports.

5. Hanger supports shall be as noted below with at least one support adjacent to the joint for each length of pipe, at each change in direction and at each branch connection. Sufficient hangers shall be provided to maintain proper slope without sagging. Support spacing shall not exceed manufacturer's recommendations, nor as listed below.

Pipe	Maximum Support Spacing (Feet)
Steel Pipe	
Under 3 inches	6
3 inches and Over	12
Cast or Ductile Iron	
Under 4 inches	6
4 inches and Over	12
Stainless Steel and Galvanized Iron	
Under 1-1/2 inches	4
1-1/2 inches to 4 inches	6
Over 4 inches	12
Copper Pipe	6
PVC Pipe	
Under 2-1/2 inches	4
2-1/2 inches and Over	6

6. Spacing of clamps for support of vertical piping shall be close enough to keep the pipe in alignment as well as to support the weight of the piping and contents unless other vertical support is shown, but in no case shall be more than 12 feet.

7. Provide adjustable hangers for all pipes, complete with adjusters, swivels, rods, etc. Size hangers to clear insulation and guide where required, as well as support piping. All rigid hangers shall provide a means of vertical adjustment after erection. Hanger rods shall be machine-threaded. Continuous threaded rods will not be allowed.

8. Clevis or band-type hangers (B-Line FIG B3100) or approved equal shall be provided as required. Strap hangers not permitted.

9. Provide floor stands, wall bracing, concrete piers, etc., for all lines running near the floors or near walls and which cannot be properly supported or suspended by the walls or floors. Pipelines near concrete or masonry walls may also be hung by hangers carried from wall brackets at a higher level than pipe. Hanging of any pipe from another is prohibited.

10. Equipment shall be positioned and aligned so that no strain shall be induced within the equipment during or subsequent to the installation of pipework.

11. When temporary supports are used, they shall be sufficiently rigid to prevent any shifting or distortion of the piping or related WORK.

C. Pipe Penetrations:

1. Exterior Watertight Entries: Seal with mechanical sleeve seals or grout, as shown in the DRAWINGS.

2. Whenever a pipe line of any material terminates at or through a structural wall or floor, install piping or sleeve in advance of pouring of concrete required for the particular installation.

3. Plastic pipe shall not be cast in concrete or masonry walls.

4. Set sleeves in position in forms and provide reinforcing around sleeves.

5. Size sleeves large enough to allow for movement due to expansion and contraction and provide for continuous insulation wrapping.

6. Extend sleeves through floors 1 inch above finished floor level and caulk sleeves.

7. Pipe other than concrete, to be cast in water-bearing walls or more than four feet below grade shall have seep rings.

8. All buried piping entering structures shall have a flexible connection installed less than two feet outside the structure line or as close to the wall as practical.

END OF SECTION

SECTION 40 05 23.72 - MISCELLANEOUS VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes miscellaneous valves not included in other Sections for use in buried service and utility vaults.

B. Section Includes:

1. Combination air/vacuum valves.
2. Ball valves, 2 inches and under.

1.2 RELATED SECTION

A. Section 05 50 00, Metal Fabrications
B. Section 09 90 00, Painting and Coating
C. Section 40 05 13, Common Work Results for Process Piping.
D. Section 40 05 51, Common Requirements Results for Process Valves.

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.

3. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.

4. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

5. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASTM International (ASTM):

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM A536 - Standard Specification for Ductile Iron Castings.

3. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

1.4 COORDINATION

A. Contractor shall be solely responsible to coordinate Work of this Section with piping, equipment, and appurtenances.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit manufacturer's latest published literature. Include illustrations, installation and maintenance instructions, and parts lists.

2. Submit valve cavitation limits.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit installation instructions and special requirements, including storage and handling procedures.

E. Lining and coating data.

F. Valve Labeling Schedule: Indicate valve locations and nametag text.

G. Certification of Valves Larger than 12 inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

H. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

I. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, including factory-applied coatings.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and actuators.
B. Operation and Maintenance Data: Submit information for valves.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

B. Tools:

1. Furnish special wrenches and other devices required for Owner to maintain equipment.

2. Furnish compatible and appropriately labeled toolbox when requested by Owner.

1.8 QUALITY ASSURANCE

A. Cast manufacturer's name, pressure rating, size of valve, and year of fabrication into valve body.

B. Valve Testing: Each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

C. Certification: Prior to shipment, submit for all valves over 12 inches in diameter, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc. Valves tested and supplied shall be trackable and traceable by serial number, tagged or otherwise noted on valve, upon arrival to Site.

D. Maintain clearances as indicated on Drawings.

E. Unless otherwise noted, all water works materials provided for the Project shall be new, of first-class quality and shall be made by reputable manufacturers.

F. All material of a like kind shall be provided from a single manufacturer, unless otherwise approved by the Engineer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

1. Store materials in areas protected from weather, moisture, or other potential damage.

2. Do not store materials directly on ground.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.

3. Provide additional protection according to manufacturer instructions.

D. Handle products carefully to prevent damage to interior or exterior surfaces.

E. All defective or damaged materials shall be replaced with new materials at no cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 VACUUM RELIEF/AIR INLET VALVES

A. Description

1. Inlet Size: 2-inch diameter

2. Fusion-bonded epoxy coating
3. All internal parts non-corrosive
4. Maximum working pressure: 285 psi or higher
5. Vacuum threshold pressure to open: 0.145 psi (1kPA).

B. Manufacturers

1. ARI K-060 VB or approved equal.

2.3 COMBINATION AIR/VACUUM VALVES

A. Description:

1. Construction: Designed to prevent solids above 2mm from entering the float/seal chamber. Conical body shape with independent spring guided linkage between the lower float/rod and the upper float sealing mechanism.

a. Inlet Size: 2-inch diameter
b. Reinforced nylon body.
c. Stainless steel internal parts.
d. Valves seats: Buna-N.

2. Manufacturers:

a. ARI D-025 or approved equal

2.4 BALL VALVES, 2 INCHES AND UNDER

A. Description:

1. Four hundred-pound. Water, oil, and gas rating (WOG) with bronze body and trim, unless otherwise shown on the Drawings.

2. Seat ring: Tetrafluoroethylene (TFE).

3. O-ring seals: Fluorocarbon.

4. Three-piece construction so that maintenance can be performed without distributing the valve body after installation.

B. Manufacturer:

1. Nibco T-590-Y or equal.

2.5 SOURCE QUALITY CONTROL

A. Testing Pressure-Reducing and Pressure-Sustaining Valves:

1. Leakage Testing:

a. Test each assembled valve hydrostatically at 1-1/2 times rated working pressure for minimum five minutes.

b. Test each valve for leakage at rated working pressure against closed valve.

c. Permitted Leakage: None.

2. Functional Testing:

a. Test each valve to verify specified performance.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install valves per manufacturer requirements and recommendations.

B. Install all valves with valve seats level.

C. Install protective strainers upstream of solenoid valves, pressure-reducing valves, and pressure-sustaining valves.

3.2 ATTACHMENTS

A. The attachments listed below, following "END OF SECTION", are part of this Section.

1. Attachment 1 – Schedule for Miscellaneous Valves.

END OF SECTION

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SECTION 40 05 51 – COMMON REQUIREMENTS RESULTS FOR PROCESS VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes basic materials and methods related to valves commonly used for process systems, including pump stations, utility vaults, and water and wastewater treatment. This Section is to be used in conjunction with Section 40 05 61 Gate Valves and Section 40 05 62 Plug Valves.

B. Section Includes:

1. Valves.
2. Valve actuators.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete Work
B. Section 05 50 00 - Metal Fabrications
C. Section 09 90 00 - Painting and Coating
D. Section 40 05 13 - Common Work Results for Process Piping

1.3 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

1. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. Through 72 In.

2. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

3. AWWA C541 - Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.

4. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

B. ASTM International (ASTM):

1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

2. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):

1. MSS SP-25 - Standard Marking System for Valves, Fittings, Flanges and Unions.

D. NSF International (NSF):

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.4 COORDINATION

A. CONTRACTOR shall be solely responsible to coordinate WORK of this Section with piping, equipment, and appurtenances.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit manufacturer's latest published literature. Include illustrations, installation and maintenance instructions, and parts lists.

2. Submit valve cavitation limits.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit installation instructions and special requirements, including storage and handling procedures.

E. Lining and coating data.

F. Valve Labeling Schedule: Indicate valve locations and nametag text.

G. Certification of Valves Larger than 12 inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

H. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

I. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections, including factory-applied coatings.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and actuators.
B. Operation and Maintenance Data: Submit information for valves.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

B. Tools:

1. Furnish special wrenches and other devices required for OWNER to maintain equipment.

2. Furnish compatible and appropriately labeled toolbox when requested by OWNER.

1.8 QUALITY ASSURANCE

A. Cast manufacturer's name, pressure rating, size of valve, and year of fabrication into valve body.

B. Valve Testing: Each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

C. Certification: Prior to shipment, submit for all valves over 12 inches in diameter, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc. Valves tested and supplied shall be trackable and traceable by serial number, tagged or otherwise noted on valve, upon arrival to Site.

D. Maintain clearances as indicated on DRAWINGS.

E. Unless otherwise noted, all water works materials provided for the Project shall be new, of first-class quality and shall be made by reputable manufacturers.

F. All material of a like kind shall be provided from a single manufacturer, unless otherwise approved by the ENGINEER.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

1. Store materials in areas protected from weather, moisture, or other potential damage.

2. Do not store materials directly on ground.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.

3. Provide additional protection according to manufacturer instructions.

D. Handle products carefully to prevent damage to interior or exterior surfaces.

E. All defective or damaged materials shall be replaced with new materials at no cost to the OWNER.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 VALVES

A. Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required and shown in the DRAWINGS.

B. Operation:

1. Open by turning counterclockwise; close by turning clockwise.

2. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

C. Valve Construction:

1. Bodies: Rated for maximum temperature and pressure to which valve will be subjected as specified in valve Sections.

D. Connecting Nuts and Bolts: Stainless steel.

2.2 VALVE ACTUATORS

A. All valves shall be furnished with manual actuators, unless otherwise indicated in the DRAWINGS.

B. Valves in sizes up to and including 4 inches in diameter shall have direct acting lever or handwheel actuators of the manufacturer's best standard design.

C. Actuators shall be sized for the valve design pressure in accordance with AWWA C504.

D. Provide actuators with position indicators for shutoff valves 6 inches and larger.

E. Comply with AWWA C541 and C542, where applicable.

F. Furnish gear operators for valves 8 inches and larger, and chainwheel operators for valves mounted over 7 feet above floor.

G. Provide gear and power actuators with position indicators.

H. Gear-Assisted Manual Actuators:

1. Provide totally enclosed gears.
2. Maximum Operating Force: 60-pound-force (lbf).
3. Bearings: Permanently lubricated bronze.
4. Packing: Accessible for adjustment without requiring removal of actuator from valve.

I. Handwheel:

1. Furnish permanently attached handwheel for emergency manual operation.

2. Rotation: None during powered operation.

3. Permanently affix directional arrow and cast OPEN or CLOSE on handwheel to indicate appropriate direction to turn handwheel.

4. Maximum Operating Force: 60 lbf.

2.3 SOURCE QUALITY CONTROL

A. Testing: Test valves according to manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping system is ready for valve installation.

3.2 PREPARATION

A. Access: All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

B. Valve Accessories: Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the CONTRACTOR to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

3.3 INSTALLATION

A. Install valves, actuators, extensions, and accessories according to manufacturer instructions.

B. Firmly support valves to avoid undue stresses on piping.

C. Coat studs, bolts, and nuts with anti-seizing lubricant.

D. Clean field welds of slag and splatter to provide a smooth surface.

E. Install valves with stems upright or horizontal, not inverted.

F. Install valves with clearance for installation of insulation and allowing access.

G. Provide access where valves and fittings are not accessible.

H. Comply with Division 40 - Process Integration for piping materials applying to various system types.

I. Valve Applications:

1. Install shutoff and drain valves at locations as indicated on DRAWINGS and as specified in this Section.

2. Install shutoff and isolation valves.

3. Isolate equipment, part of systems, or vertical risers as indicated on DRAWINGS.

4. Install valves for throttling, bypass, or manual flow control services as indicated on DRAWINGS.

J. Disinfection of Water Piping System:

1. Flush and disinfect system as specified in Section 33 13 00, Testing of Utility Piping.

3.4 FIELD QUALITY CONTROL

A. Valve Field Testing:

1. Test for proper alignment.

2. If specified by valve Section, field test equipment to demonstrate operation without undue leakage, noise, vibration, or overheating.

3. ENGINEER will witness field testing.

END OF SECTION

SECTION 40 05 51.24 - CHECK VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Work in this Section includes check valves for use in water and wastewater facilities. Work includes the furnish and install of all swing and silent check valves, complete, as shown on the Drawings and specified herein, including coating and lining, appurtenances, operators, and accessories.

B. Section includes:

1. Swing check valves, 1-inch through 4-inch diameter.
2. Swing check valves, 4-inch diameter and larger.

1.2 RELATED SECTIONS:

A. Section 40 05 51 - Common Requirements Results for Process Valves

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings.

B. ASTM International (ASTM):

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
2. ASTM A536 - Standard Specification for Ductile Iron Castings.
3. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
4. ASTM B148 - Standard Specification for Aluminum-Bronze Sand Castings.
5. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
6. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
7. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
8. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

C. American Water Works Association (AWWA):

1. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.

D. NSF International (NSF):

1. NSF 61 - Drinking Water System Components - Health Effects.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. As required by Section 40 05 51, Common Requirements Results for Process Valves.

PART 2 PRODUCTS

2.1 SWING CHECK VALVES, 1-INCH THROUGH 4-INCH DIAMETER

A. Description:

1. Horizontal T-pattern style.
2. 200# WOG.
3. Capable of functioning in the vertical position.
4. Connections shall be standard threaded or threaded for fire hose connections where shown on plans

B. Materials:

1. Body Cap and Disc: Brass conforming to ASTM B584 C85400.

C. Manufacturer:

1. Figure 246 as manufactured by Red White Valve.

2.2 SWING CHECK VALVES, 4-INCH DIAMETER AND LARGER

A. Description:

1. Meeting requirements of AWWA C508.

2. Type: Swing, resilient-seated, with outside lever and adjustable weight.

3. Flow Area: Full open.

4. Mounting: Horizontal or vertical.

5. Shall close tightly when the pressure downstream of the valve disc exceeds the upstream pressure.

6. Working Pressure: 150 psi

7. Tight sealing, shockless in operation and absolutely prevent the return of water back through the valve.

8. The disc shall be attached to the sic arm by means of a center pin, disc nut, and washer providing 360-degree angular articulation but not rotation.

9. Pin Shaft:

    a. Discs shall be suspended from a non-corrosive hinge pin shaft that shall rotate freely without the need for external lubrication.

    b. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing.

10. End Connections: As shown on Drawings. End connections shall be rated to the working pressure requirements specified above.

B. Materials:

1. Body and Disc: Constructed of heavy cast iron conforming to ASTM A126 class B, or ductile iron conforming to ASTM A536.

2. Cover: Steel conforming to ASTM A36 or Ductile iron conforming to ASTM A536.

3. Disc Arm: Ductile iron conforming to ASTM A536.

4. Body Seat: Type 316 stainless steel or Bronze ASTM B62.

5. Disc Seat: Field-replaceable, NBR or Buna-N.

6. Hinge Pin and Key: Stainless steel.

7. Rubber Components: NBR or Buna-N.

8. Connecting Hardware: Stainless steel.

C. Finishes:

1. Epoxy lining and coating conforming to AWWA C550.

D. Manufacturer:

1. GA Industries, Figure No. 220-D.
2. Cla-Val, 585 Series.
3. Approved equal.

2.3 SOURCE QUALITY CONTROL

A. Testing:

1. Hydrostatically test check valves at twice rated pressure, in conformance with requirements of AWWA C508.

2. Permitted Leakage at Indicated Working Pressure: None.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install check valves according to AWWA C508, Section 40 05 51 Common Requirements Results for Process Valve, and as recommended by manufacturer.

3.2 SERVICES PROVIDED BY MANUFACTURER'S REPRESENTATIVES

A. Provide the services of the valve manufacturer's representative to verify proper installation of the valves and to adjust the valves when construction is complete.

END OF SECTION

SECTION 40 05 61 - GATE VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes gate valves for use in buried service, pump stations, and utility vaults. Coordinate with Section 40 05 51, Common Requirements Results for Process Valves.

B. Section Includes:

1. Resilient-seated gate valves.

1.2 RELATED SECTIONS

A. Section 40 05 13, Common Work Results for Process Piping
B. Section 40 05 51, Common Requirements Results for Process Valves.

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.

3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

4. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASTM International (ASTM):

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

3. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. American Water Works Association (AWWA):

1. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
2. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants.

D. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):

1. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends.
2. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

E. NSF International (NSF):

1. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects
2. NSF/ANSI Standard 372 - Drinking Water System Components - Lead Content

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. As required by Section 40 05 51, Common Requirements Results for Process Valves.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the "lead free" requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for "lead free".

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 RESILIENT-SEATED GATE VALVES

A. Description:

1. Comply with AWWA C509.

2. Minimum Pressure Rating:

a. Twelve-inch Diameter and Smaller: 200 pounds per square inch (gauge) (psig).
b. Sixteen-inch Diameter and Larger: 150 psig.

3. End Connections: As shown in the DRAWINGS.

a. Standard mechanical joint ends comply with ANSI/AWWA C111.

b. Flanged end dimensions and drilling comply with ANSI/ASME B16.1, class 125. Comply with AWWA C115 & ASME 16.5.

1) The CONTRACTOR shall coordinate with pipe, valve, and fitting suppliers to make certain pipe, valve, and fitting flanges match in bolt pattern.

4. Gear Actuators: Conforming to AWWA C509 for manual valves.

5. Linings and Coatings:

a. Corrosion-resistant fusion bonded epoxy conforming to AWWA C550 and NSF 61.
b. All internal and external ferrous surfaces.
c. Do not coat flange faces of valves.

6. Bi-directional flow.

B. Operation:

1. Non-rising stem.

2. Open counterclockwise when viewing the valve from above, unless otherwise indicated in the DRAWINGS.

3. Buried Valves: All buried valves shall be provided with 2-inch square operating nuts.

4. In-Plant Service Valves: Valves for in-plant or exposed service shall be furnished with handwheel operators, unless otherwise specified in Section 40 05 51, Common Requirements Results for Process Valves.

C. Materials:

1. Wedge:

a. ASTM A126, cast iron or ASTM A536, ductile iron.
b. Fully encapsulated with molded rubber.

2. Body and Bonnet:

a. ASTM A126, cast iron or ASTM A536, ductile iron.

3. Stem, Stem Nuts, Glands, and Bushings: ASTM B584, bronze.

4. Valve Body Bolting: Stainless steel.

D. Manufacturers:

1. Clow Valve Company.
2. M&H Valve.
3. U.S. Pipe.
4. Mueller Company.

2.3 SOURCE QUALITY CONTROL

A. Testing: Test gate valves according to AWWA C509.

PART 3 EXECUTION

3.1 INSTALLATION

A. As required by Section 40 05 51 - Common Requirements Results for Process Valves.
B. Install according to manufacturer's instructions.
C. Support valves in plastic piping to prevent undue stresses on piping.

END OF SECTION

SECTION 40 05 62 - PLUG VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes plug valves for use in water and wastewater treatment plants.

B. Section Includes:

1. Eccentric plug valves.

C. Related Requirements:

1. Section 40 05 51 - Common Requirements Results for Process Valves.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.
3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
4. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASTM International (ASTM):

1. ASTM A536 - Standard Specification for Ductile Iron Castings.
2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

C. American Water Works Association (AWWA):

1. AWWA C517 - Resilient-Seated Cast-Iron Eccentric Plug Valves.
2. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit catalog information, indicating materials of construction and compliance with indicated standards.

C. Source Quality-Control Submittals: Indicate results of shop/factory tests and inspections.

PART 2 PRODUCTS

2.1 ECCENTRIC PLUG VALVES

A. Manufacturers:

1. DeZurik, Model PEF
2. Approved equal.

B. Description:

1. Type: Non-lubricated, eccentric.

2. Minimum Working Pressure: 150 pounds per square inch (gauge) (psig).

3. Ports: Round. Passage size shall be 100 percent of the full port area on all sizes for minimum pressure drop.

4. Stem Bearings: Self-lubricating.

5. Stem Seals: Neoprene; V-ring type.

6. Packing and Gland: Accessible and externally adjustable.

7. End Connections: ASME B16.1, flanged.

C. Operation:

1. Greater than 3 inches: Worm gear manual operators.

   a. Provide with handwheel, except when buried.
   b. Actuator mechanism shall be fully isolated from line media.

D. Materials:

1. Body: AWWA C517, cast iron.

2. Wall Thickness: AWWA C504.

3. Plug:

   a. AWWA C517, cast iron.

   b. ASTM A 536, ductile iron. lined with resilient coating as recommended by valve manufacturer for service conditions.

4. Seats: To match material of body.

5. Stem: Type 316 stainless steel.

6. Stem Bearings: Stainless steel.

7. Seals: Cartridge type with two O-rings, or V-cup type, self-adjusting, wear compensating. Packing shall be replaceable without removing the valve bonnet or plug.

8. Connecting Hardware: Type 316 stainless steel.

E. Finishes: As specified in Section 40 05 51, Common Requirements Results for Process Valves.

2.2 SOURCE QUALITY CONTROL

A. Performance Testing:

1. Operate each valve and actuator from fully CLOSED to fully OPEN to fully CLOSED under no-flow conditions.

B. Leakage Testing:

1. Test at indicated working pressure to ensure valves are drip tight. Test with pressure in both directions for 5 minutes each way.

C. Hydrostatic Testing:

1. Perform test at twice rated pressure. Test for at least 1-minute to ensure no leakage.

PART 3 EXECUTION

3.1 LOCATION

A. Valve and actuators shall be located and oriented as shown on the DRAWINGS.

B. When not shown on the DRAWINGS, coordinate positions and orientations of seats and actuators with the ENGINEER prior to installation.

3.2 INSTALLATION

A. Install valves according to Section 40 05 51, Common Requirements Results for Process Valves, AWWA C517 and as recommended by manufacturer.

B. Install plug valves in horizontal piping with the stem horizontal such that the valve seat is on the downstream side of the valve body and the plug is at the top of the valve when the valve is open; install plug valves in vertical piping with plug at top when closed.

C. Install such that plugs are on top when OPEN and on pressure side when CLOSED.

END OF SECTION

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SECTION 40 91 00 - PROCESS INSTRUMENTATION AND CONTROL

PART 1 GENERAL

1.1 THE REQUIREMENT

A. GENERAL

1. This project consists of major mechanical, electrical and control upgrades to the South Welches, Golf Club Terrace, 82nd Ave and Sieben Lane pump station.

2. Specific instrumentation and control task included in this project are listed below:

   a. Build, install and test a new control panel at each pump station.

   b. Procure, install and configure new instrumentation at each pump station. See instrument list in section 40 91 00 2.1.

3. Programmable Logic Controller (PLC), Human Machine Interface (HMI) and Supervisory control programming and integration will be provided by the client or client specified integrator/programmer.

B. The CONTRACTOR shall provide local Process Control and Instrumentation System (PICS) for each subsystem or piece of equipment that is complete and operable in accordance with the Contract Documents.

C. The Work is located at existing sites, which has wastewater pumping facilities in operation. The CONTRACTOR shall coordinate its work to minimize disruption of existing facilities.

1.2 RESPONSIBILITIES

A. The CONTRACTOR shall perform the following work:

1. Implementation of PICS

   a. Prepare submittals as called out in this and following sections in Division 40.

   b. Procure (PICS) hardware

   c. Build and test control panels/systems

   d. Prepare spare parts submittals

   e. Oversee and certify installation, startup and commissioning of PICS supplied equipment, instruments, and control panels.

f. Track and document field markups and modifications to control system wiring. Provide final record drawings of control panel and instrument wiring schematics for inclusion in O&M manual.

g. Conduct performance test on PICS supplied equipment.

h. Prepare owner's O&M manual for PICS supplied equipment

i. Conduct training for PICS supplied equipment.

j. Provide spare parts for PLC/Control components as called out in specifications.

B. Control and SCADA Programming:

1. The client or client specified integrator/programmer will provide programming, integration and startup testing for PLC/HMI at each Pump station.

PART 2 PRODUCTS

2.1 THE REQUIREMENT

A. GENERAL

1. South Welches Pump Station Control Panel and Instrumentation:

a. The PICS CONTRACTOR shall provide the South Welches pump station control panel per specifications and drawings.

b. The PICS CONTRACTOR shall provide instruments for South Welches pump station per specifications (see instrument list below) and drawings.

1) South Welches Pump Station Instrument List:

TAG	INSTRUMENT	DESCRIPTION	SPECIFICATION	RANGE/SIZE
LI-1001	Wet Well Level Sensor	Hydrostatic Pressure Measurement, redundant	40 91 08	0-20 ft
LI-1002	Wet Well Level Sensor	Hydrostatic Pressure Measurement, redundant	40 91 08	0-20 ft
LSH-1010	Wet Well High Level Sensor	Float Switch	40 91 07	n/a
LSHH-1010	Wet Well High High Level Sensor	Float Switch	40 91 07	n/a
LSHH-1011	Over flow float sensor	Float Switch	40 91 07	n/a
PI-1111	Pressure Gauge	Pump discharge pressure	40 91 09	0-60 psi
PI-1112	Pressure Gauge	Pump discharge pressure	40 91 09	0-60 psi
YS-1001	Smoke Detector	Smoke Alarm	40 91 14	NA
YS-1002	Intrusion Switch	Building Intrusion	40 91 12	NA

2. Golf Club Terrace Pump Station Control Panel and Instrumentation:

   a. The PICS CONTRACTOR shall provide the Golf Club Terrace pump station control panel per specifications and drawings.

   b. The PICS CONTRACTOR shall provide instruments for Golf Club Terrace pump station per specifications (see instrument list below) and drawings.

      1) Golf Club Terrace Pump Station Instrument List:

TAG	INSTRUMENT	DESCRIPTION	SPECIFICATION	RANGE/SIZE
LI-1001	Wet Well Level Sensor	Hydrostatic Pressure Measurement, redundant	40 91 08	0-20 ft
LI-1002	Wet Well Level Sensor	Hydrostatic Pressure Measurement, redundant	40 91 08	0-20 ft
LSH-1010	Wet Well High Level Sensor	Float Switch	40 91 07	n/a
LSHH-1010	Wet Well High High Level Sensor	Float Switch	40 91 07	n/a
LSHH-1011	Over flow float sensor	Float Switch	40 91 07	n/a
PI-1111	Pressure Gauge	Pump discharge pressure	40 91 09	0-30 psi
PI-1112	Pressure Gauge	Pump discharge pressure	40 91 09	0-30 psi
YS-1001	Smoke Detector	Smoke Alarm	40 91 14	NA
YS-1002	Intrusion Switch	Building Intrusion	40 91 12	NA

3. 82nd Pump Station Control Panel and Instrumentation:

   a. The PICS CONTRACTOR shall provide the 82nd pump station control panel per specifications and drawings.

   b. The PICS CONTRACTOR shall provide instruments for 82nd pump station per specifications (see instrument list below) and drawings.

      1) 82nd Pump Station Instrument List:

TAG	INSTRUMENT	DESCRIPTION	SPECIFICATION	RANGE/SIZE
LI-1001	Wet Well Level Sensor	Hydrostatic Pressure Measurement, redundant	40 91 08	0-20 ft
LI-1002	Wet Well Level Sensor	Hydrostatic Pressure Measurement, redundant	40 91 08	0-20 ft
LSH-1010	Wet Well High Level Sensor	Float Switch	40 91 07	n/a
LSHH-1010	Wet Well High High Level Sensor	Float Switch	40 91 07	n/a
LSHH-1011	Over flow float sensor	Float Switch	40 91 07	n/a
PI-1111	Pressure Gauge	Pump discharge pressure	40 91 09	0-30 psi
PI-1112	Pressure Gauge	Pump discharge pressure	40 91 09	0-30 psi

4. Sieben Lane Pump Station Control Panel and Instrumentation:

   a. The PICS CONTRACTOR shall provide the Sieben Lane pump station control panel per specifications and drawings.

   b. The PICS CONTRACTOR shall provide instruments for Sieben Lane pump station per specifications (see instrument list below) and drawings.

      1) Sieben Lane Pump Station Instrument List

TAG	INSTRUMENT	DESCRIPTION	SPECIFICATION	RANGE/SIZE
PT-1001	Wet Well Level Sensor	Hydrostatic Pressure Measurement, redundant	40 91 08	0-20 ft
PT-1002	Wet Well Level Sensor	Hydrostatic Pressure Measurement, redundant	40 91 08	0-20 ft
LSH-1010	Wet Well High Level Sensor	Float Switch	40 91 07	n/a
LSHH-1010	Wet Well High High Level Sensor	Float Switch	40 91 07	n/a
LSHH-1011	Wet Well Overflow Sensor	Float Switch	40 91 07	n/a
LSH-1009	Valve Vault High Level	Float Switch	40 91 07	n/a
YS-1001	Smoke Detector	Smoke Detector, Electrical Room non-classified area	40 91 14	n/a
FIT-1008	Flow Meter	Discharge Flow	40 91 23	10 inch
YS-1003	Intrusion Detection	Door Switch 1A, Electrical Room	40 91 12	n/a
YS-1004	Intrusion Detection	Door Switch 1B, Electrical Room	40 91 12	n/a

PART 3 EXECUTION

3.1 THE REQUIREMENT

A. Perform the system testing described below.

1. For each control panel, instrument or equipment provided by PICS shall be tested and configured by the CONTRACTOR and be determined to be ready for operation and testing.

3.2 RESPONSIBILITIES

A. SUBMITTALS:

1. The CONTRACTOR shall provide submittals for the control panels, instruments and any other PICS supplied equipment as described below.

2. See section 409200 for specific requirements of control panel and component submittal.

3. See individual instrument specifications for specific requirements for instrumentation submittals.

B. STARTUP TESTING/QUALITY ASSURANCE:

1. Upon completion of installation of PLC system, control panel or instrument, the CONTRACTOR shall complete startup testing. At a minimum startup testing shall consist of the following.

2. Power verification: verify proper supply power voltage is applied to the panel, device or instrument.

3. Field IO checkout: Verify instrument IO points are properly terminated at the device and control panel and the signals are functioning properly.

4. Instrument configuration: configure instruments to provide proper signals to the control system and local displays.

5. Verify proper operation of all instruments and sensors.

6. Verify proper operation of all motors and actuators.

C. GAURANTEE:

1. The contractor shall repair or replace any control system components that fail or are found defective during the original equipment manufacturer's warranty period.

D. PRODUCT HANDLING:

1. The CONTRACTOR shall crate or package control equipment and instrumentation as needed to prevent damage during shipping to the work site. This includes protection from physical damage and moisture.

E. MANUFACTURER'S REPRESENTATIVE SERVICES:

1. The CONTRACTOR shall employ the services of the manufacture to startup and commission contractor supplied standalone control systems at each pump station site. The representative shall ensure proper operation of the equipment and control system in local mode prior to running the system in remote automatic

mode. Manufacturer's representative services for individual instruments are not required unless called out in the individual instrument specification section.

END OF SECTION

SECTION 40 91 07 -LEVEL DETECTION DEVICES

PART 1 GENERAL

1.1 THE REQUIREMENT

A. **General:** The CONTRACTOR shall furnish and install all liquid level measuring systems, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 91 00 - Process Control and Instrumentation Systems apply to this Section.

C. See section 40 91 00 for instrument list.

1.2 CONTRACTOR SUBMITTALS

A. **General:** The Shop Drawings and Technical Manual, shall be submitted in conformance with Section 40 91 00 and Section 01 33 00 – Submittal Procedures.

B. **Detail:** Provide specific part numbers, selected options for each component or part so as to clearly indicate what item has been selected. Provide details for any selected accessories or additional item needed for each component. Clearly note any exceptions to the item specifications.

1.3 QUALITY ASSURANCE

A. **General:** The accuracy of each instrumentation system or loop shall include the following.

1. Verify proper power and signal wire terminations.
2. Ensure proper power voltage is applied to the device.
3. Check for correct output signal

1.4 MANUFACTURER'S REPRESENTATIVE SERVICES

A. **General:** None required for this section

1.5 PRODUCT HANDLING

A. **General:** Product shall be properly crated to prevent damage and moisture intrusion during shipping and handling.

PART 2 PRODUCTS

2.1 GENERAL

All devices specified herein shall conform to the requirements of the Contract Documents.

2.2 FLOAT LEVEL SWITCH

A. Where point level measurement in a liquid is indicated, a float type level switch shall be used.

B. Wet Well application float level switch shall have the following attributes:

1. Mercury free, self-counter weighted float switch.
2. Polypropylene body
3. Cable length minimum 30ft or as required for application. PVC cable.
4. Dry contact outputs, Single Pole Double Throw (SPDT) contact arrangement
5. IP68 rated housing body

C. Drywell application float level switch shall have the following attributes:

1. Vertical float switch
2. Buna N and Epoxy float
3. Minimum 24” wire leads
4. Reversible float for changing contact output action.

D. MANUFACTURER:

1. Dwyer FSW2 Series for use in Wet Well application
2. Dwyer F7 Series for use in Drywell application
3. OR ENGINEER approved equal.

E. SCOPE OF SUPPLY: The CONTRACTOR shall provide the following single point level sensors

1. See instrument list for Group 3 Pump Station located in section 40 91 00 2.1.A

PART 3 EXECUTION

3.1 GENERAL

Installation and wiring shall be per manufacture’s requirements.

END OF SECTION

SECTION 40 91 08 - SUBMERSIBLE LEVEL SENSOR

PART 1 GENERAL

1.1 THE REQUIREMENT

A. General: The CONTRACTOR shall furnish and install all liquid level measuring (submersible pressure) systems, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 91 00 - Process Control and Instrumentation Systems apply to this Section.

C. See section 40 91 00 for instrument list.

1.2 CONTRACTOR SUBMITTALS

A. General: The Shop Drawings and Technical Manual, shall be submitted in conformance with Section 40 91 00 and Section 01 33 00 - Submittal Procedures.

B. Detail: Provide specific part numbers, selected options for each component or part so as to clearly indicate what item has been selected. Provide details for any selected accessories or additional item needed for each component. Clearly note any exceptions to the item specifications.

1.3 QUALITY ASSURANCE

A. General: The accuracy of each instrumentation system or loop shall include the following.

1. Verify proper power and signal wire terminations.
2. Ensure proper power voltage is applied to the device.
3. Check for correct output signal

1.4 MANUFACTURER'S REPRESENTATIVE SERVICES

A. General: None required for this section

1.5 PRODUCT HANDLING

A. General: Product shall be properly crated/protected to prevent damage and moisture intrusion during shipping and handling.

PART 2 PRODUCTS

2.1 GENERAL

All devices specified herein shall conform to the requirements of the Contract Documents.

2.2 HAZARDOUS AREA SUBMERSIBLE LEVEL SENSOR

A. Where level measurement by submerged pressure sensor in Class 1 Div 1 classified areas is required.

B. Submersible level sensor shall have the following attributes:

1. 24VDC loop power supply.
2. 4-20mA analog output signal, two wire
3. Diaphragm: 316 SS
4. Housing: 316SS
5. Wetted Seals: Viton or Equivalent
6. Cable Jacket: Polyethylene, FEP, Polyurethane, Tefzel or equal
7. Cable Length: 50ft or as required
8. 42mm large diameter sensor for waste water applications.
9. Intrinsically safe rating for use in Class 1 Division 1 area.
10. Accessories: Cable suspension hardware and cable clamp and weight.
11. Accessories: Include intrinsic barrier, Turck IM31-11EX-I or equal

C. MANUFACTURE:

1. Endress-Hauser Waterpilot FMX 21
2. WIKA IL-10
3. OR ENGINEER approved equal.

D. SCOPE OF SUPPLY: The CONTRACTOR shall provide the following pressure sensor

1. See instrument list for Group 3 Pump Station located in section 40 91 00 2.1.A

PART 3 EXECUTION

3.1 GENERAL:

Installation and wiring shall be per manufacture’s requirements.

END OF SECTION

SECTION 40 91 09 - PRESSURE DETECTION DEVICES

PART 1 GENERAL

1.1 THE REQUIREMENT

A. **General:** The CONTRACTOR shall furnish and install all pressure detection devices, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 91 00 - Process Control and Instrumentation Systems apply to this Section.

C. See section 40 91 00 for instrument list.

1.2 CONTRACTOR SUBMITTALS

A. **General:** The Shop Drawings and Technical Manual, shall be submitted in conformance with Section 40 91 00 and Section 01 33 00 – Submittal Procedures.

B. **Detail:** Provide specific part numbers, selected options for each component or part so as to clearly indicate what item has been selected. Provide details for any selected accessories or additional item needed for each component. Clearly note any exceptions to the item specifications.

1.3 QUALITY ASSURANCE

A. **General:** The accuracy of each instrumentation system or loop shall include the following.

1. Verify proper power and signal wire terminations.
2. Ensure proper power voltage is applied to the device.
3. Check for correct output signal

1.4 MANUFACTURER'S REPRESENTATIVE SERVICES

A. **General:** None required for this section

1.5 PRODUCT HANDLING

A. **General:** Product shall be properly crated/protected to prevent damage and moisture intrusion during shipping and handling.

PART 2 PRODUCTS

2.1 GENERAL:

All devices specified herein shall conform to the requirements of the Contract Documents.

2.2 ELECTRONIC GAUGE PRESSURE TRANSMITTERS

A. The transmitter shall be a 2-wire, high-performance capacitive pressure transmitter.

B. Measure capacitance changes in the sensor as pressure varies and produces a linear 4-20mA DC output proportional to the pressure. The unit shall have self-diagnostic capability and non-volatile memory.

C. Display shall be an integrally mounted 4-line LCD scaled with engineering units.

D. Transmitter shall have a static pressure limit at least 1.5 times the nominal pressure range. Unit shall use DC loop-power supply 10.5 to 45 VDC with self-diagnostic capability and a non-volatile memory.

E. Sensor shall be a high purity aluminum oxide ceramic element with no oil fill and an elastomer seal.

F. The unit shall be rated for process temperature of minus 40°F to 266°F (302 °F for 1 hour) and an ambient environment of minus 40 degrees F to 185 degrees F.

G. Reference accuracy shall be +/- .075% of calibrated span including non-linearity hysteresis and non-reproducibility in accordance with IEC 60770. Total performance accuracy including non-linearity hysteresis and non-reproducibility in addition to thermal change of the zero point shall be +/- .2% URL.H. Unit shall have ATEX, FM, CSA or IECEx approvals as required.

H. Aluminum or Stainless Steel (316SS) housing, NEMA 4X/6P, ½ inch NPT electrical connections.

I. ½-inch NPT, 316 Stainless process connection with block and bleed valve.

J. Diaphragm seals (with oil fill) shall be provided for transmitters, except those mounted on air and potable waterlines

K. MANUFACTURER:

1. Endress Hauser Cerabar M PMC51
2. Rosemount 3051GP
3. OR Engineer approved equal

L. SCOPE OF SUPPLY:

1. See instrument list for Group 3 Pump Station located in section 40 91 00 2.1.A.

2.3 PRESSURE GAUGE

A. Pressure gauges shall be 4-1/2 inches in diameter, liquid-filled, bottom connected, with white laminated dials and black graduations. Windows shall be shatterproof glass. Gauges shall have a blowout disc and be encased in phenolic, steel or cast iron. Measuring element shall be a stainless steel bourdon tube with welded, stress-relieved joints. Socket shall have wrench flats. Movement shall be rotary geared, all stainless steel material. All pressure gauges shall be provided with a pulsation snubber constructed of 316 stainless steel and a ball isolation valve. Accuracy shall be plus or minus 0.5 percent range to 150 percent of the working pressure or vacuum of the pipe or vessel to which they are connected.

B. Diaphragm seals (with oil fill) shall be provided for all gauges, except those mounted on air and potable waterlines.

C. MANUFACTURER:

1. Ashcroft 1279
2. OR engineer approved equal

D. SCOPE OF SUPPLY

1. See instrument list for Group 3 Pump Station located in section 40 91 00 2.1.A

PART 3 EXECUTION

3.1 GENERAL:

Installation and wiring shall be per manufacture's requirements.

END OF SECTION

SECTION 40 91 11 - AIR FLOW SWITCHES

PART 1 GENERAL

1.1 THE REQUIREMENT

A. **General:** The CONTRACTOR shall furnish and install all alarm indicator devices, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 91 00 - Process Control and Instrumentation Systems apply to this Section.

C. See section 40 91 00 for instrument list.

1.2 CONTRACTOR SUBMITTALS

A. **General:** The Shop Drawings and Technical Manual, shall be submitted in conformance with Section 40 91 00 and Section 01 33 00 - Submittal Procedures.

1.3 QUALITY ASSURANCE

A. **General:** The accuracy of each instrumentation system or loop shall include the following.

1. Verify proper power and signal wire terminations.
2. Ensure proper power voltage is applied to the device.
3. Check for correct output signal

1.4 MANUFACTURER'S REPRESENTATIVE SERVICES

A. **General:** None required for this section

1.5 PRODUCT HANDLING

A. **General:** Product shall be properly crated/protected to prevent damage and moisture intrusion during shipping and handling.

PART 2 PRODUCTS

2.1 GENERAL:

A. All devices specified herein shall conform to the requirements of the Contract Documents.

2.2 VENTILATION AIR FLOW SWITCH

A. Air flow switch used to detect if ventilation system is not operating

B. CHARACTARISTICS:

1. Air velocity range: 197-1969 feet per minute
2. Temperature 5-122F temperature range
3. Contact rating: 3A

4. LED indicators
5. 5% repeatability
6. Enclosure rating: Nema 4X
7. Mounting: manufacturer supplied clamp
8. Power: 24VDC Power

C. MANUFACTURER: Indicators shall be as manufactured by:

1. Dwyer AVFS-02
2. ENGINEER approved equal.

D. SCOPE OF SUPPLY

1. See instrument list for Group 2 Pump Station located in section 40 91 00 2.1.A.

PART 3 EXECUTION

3.1 GENERAL:

A. Installation and wiring shall be per the manufacturer's requirements.

END OF SECTION

SECTION 40 91 12 - INTRUSION DETECTION SWITCHES

PART 1 GENERAL

1.1 THE REQUIREMENT

A. General: The CONTRACTOR shall furnish and install all alarm indicator devices, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 91 00 - Process Control and Instrumentation Systems apply to this Section.

C. See section 40 91 00 for instrument list.

1.2 CONTRACTOR SUBMITTALS

A. General: The Shop Drawings and Technical Manual, shall be submitted in conformance with Section 40 91 00 and Section 01 33 00 – Submittal Procedures.

1.3 QUALITY ASSURANCE

A. General: The accuracy of each instrumentation system or loop shall include the following.

1. Verify proper power and signal wire terminations.
2. Ensure proper power voltage is applied to the device.
3. Check for correct output signal

1.4 MANUFACTURER'S REPRESENTATIVE SERVICES

A. General: None required for this section

1.5 PRODUCT HANDLING

A. General: Product shall be properly crated/protected to prevent damage and moisture intrusion during shipping and handling.

PART 2 PRODUCTS

2.1 GENERAL:

A. All devices specified herein shall conform to the requirements of the Contract Documents.

2.2 DOOR MOUNT INTRUSION DETECTION SWITCH

A. Door mount switches are used to detect entry into a room.

B. CHARACTARISTICS:

1. Magnetic type
2. Hermetically sealed reed switch with matching magnet
3. Wide gap sensing with SPDT contacts
4. Aluminum housing and mounting bracket, armored cable

C. MANUFACTURER: Switches shall be as manufactured by:

1. Interlogix (formerly GE Sentrol) 2507A-L series
2. ENGINEER approved equal.

D. SCOPE OF SUPPLY

1. See instrument list for Group 3 Pump Station located in section 40 91 00 2.1.A

PART 3 EXECUTION

3.1 GENERAL:

1. Installation and wiring shall be per manufacture's requirements.

END OF SECTION

SECTION 40 91 13 - ALARM INDICATORS

PART 1 GENERAL

1.1 THE REQUIREMENT

A. **General:** The CONTRACTOR shall furnish and install all alarm indicator devices, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 91 00 - Process Control and Instrumentation Systems apply to this Section.

C. See section 40 91 00 for instrument list.

1.2 CONTRACTOR SUBMITTALS

A. **General:** The Shop Drawings and Technical Manual, shall be submitted in conformance with Section 40 91 00 and Section 01 33 00 – Submittal Procedures.

1.3 QUALITY ASSURANCE

A. **General:** The accuracy of each instrumentation system or loop shall include the following.

1. Verify proper power and signal wire terminations.
2. Ensure proper power voltage is applied to the device.
3. Check for correct output signal

1.4 MANUFACTURER'S REPRESENTATIVE SERVICES

A. **General:** None required for this section

1.5 PRODUCT HANDLING

A. **General:** Product shall be properly crated/protected to prevent damage and moisture intrusion during shipping and handling.

PART 2 PRODUCTS

2.1 GENERAL:

A. All devices specified herein shall conform to the requirements of the Contract Documents.

2.2 INDOOR/OUTDOOR WARNING LIGHT

A. Warning lights generally provide status indication for safety for entry into potentially hazardous areas

B. CHARACTARISTICS:

1. Contact closure activates each light
2. Steady on LED indicator light

3. Indoor/Outdoor capable, polycarbonate dome, Nema 4X or IP65 rating
4. Color: as indicated in instrument list
5. Mounting: ½ inch pipe unless otherwise noted
6. Power: 120VAC, 60Hz
7. Light Type: LED

C. MANUFACTURER: Indicators shall be as manufactured by:

1. Edwards Signal Adaptalight 101 series
2. Federal Signal Model RSL-LMS series
3. ENGINEER approved equal.

D. SCOPE OF SUPPLY

1. See instrument list for Group 2 located in section 40 91 00 2.1.A.

PART 3 EXECUTION

3.1 GENERAL:

A. Installation and wiring shall be per manufacturer's requirements.

END OF SECTION

SECTION 40 91 14 - SMOKE DETECTORS

PART 1 GENERAL

1.1 THE REQUIREMENT

A. General: The CONTRACTOR shall furnish and install all alarm indicator devices, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 91 00 - Process Control and Instrumentation Systems apply to this Section.

C. See section 40 91 00 for instrument list.

1.2 CONTRACTOR SUBMITTALS

A. General: The Shop Drawings and Technical Manual, shall be submitted in conformance with Section 40 91 00 and Section 01 33 00 – Submittal Procedures.

1.3 QUALITY ASSURANCE

A. General: The accuracy of each instrumentation system or loop shall include the following.

1. Verify proper power and signal wire terminations.
2. Ensure proper power voltage is applied to the device.
3. Check for correct output signal

1.4 MANUFACTURER'S REPRESENTATIVE SERVICES

A. General: None required for this section

1.5 PRODUCT HANDLING

A. General: Product shall be properly crated/protected to prevent damage and moisture intrusion during shipping and handling.

PART 2 PRODUCTS

2.1 GENERAL:

A. All devices specified herein shall conform to the requirements of the Contract Documents.

2.2 SMOKE DETECTOR FOR NON CLASSIFIED AREAS

A. For monitoring interior space for the presence of smoke/fire.

B. CHARACTARISTICS:

1. Combination photoelectric/thermal type smoke detection
2. Integral heat sensor, set to 135 degrees Fahrenheit.
3. 85 dBA audible alarm
4. Test switch
5. LED indicators
6. 4 wire, 24VDC powered with form C dry contacts for alarm
7. Ceiling mount
8. UL268 listed

C. MANUFACTURER: Smoke detectors shall be as manufactured by:

1. System Sensor I3 Series model 4WTAR-B
2. ENGINEER approved equal.

D. SCOPE OF SUPPLY

1. See instrument list for Group 3 Pump Station located in section 40 91 00 2.1.A.

2.3 SMOKE DETECTOR FOR CLASSIFIED AREAS

A. For monitoring interior space for the presence of smoke/fire in classified areas.

B. CHARACTARISTICS:

1. Photoelectric type smoke detection
2. Rated for Class 1, Division 1 environment.
3. Dual LED status indicator lights
4. 2 wire, 24VDC powered, analog detection circuit
5. Ceiling mount
6. Include intrinsically safe mounting base
7. Include intrinsically safe barrier
8. Requires analog signal alarm relay (included in control panel) with range set to -100mA to detect alarm condition.

C. MANUFACTURER: Smoke detectors shall be as manufactured by:

1. Safety System Technologies Model S270 with IS barrier model 289-02 and IS mounting base model 280-14

2. ENGINEER approved equal.

D. SCOPE OF SUPPLY

1. See instrument list for Group 3 Pump Station located in section 40 91 00 2.1.A

PART 3 EXECUTION

3.1 GENERAL:

1. Installation and wiring shall be per manufacturer's requirements.

END OF SECTION

SECTION 40 91 15 - CURRENT DETECTION SWITCHES

PART 1 GENERAL

1.1 THE REQUIREMENT

A. General: The CONTRACTOR shall furnish and install all current detection devices, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 91 00 - Process Control and Instrumentation Systems apply to this Section.

C. See section 40 91 00 for instrument list.

1.2 CONTRACTOR SUBMITTALS

A. General: The Shop Drawings and Technical Manual, shall be submitted in conformance with Section 40 91 00 and Section 01 33 00 – Submittal Procedures.

1.3 QUALITY ASSURANCE

A. General: The accuracy of each instrumentation system or loop shall include the following.

1. Verify proper power and signal wire terminations.
2. Ensure proper power voltage is applied to the device.
3. Check for correct output signal

1.4 MANUFACTURER'S REPRESENTATIVE SERVICES

A. General: None required for this section

1.5 PRODUCT HANDLING

A. General: Product shall be properly crated/protected to prevent damage and moisture intrusion during shipping and handling.

PART 2 PRODUCTS

2.1 GENERAL:

A. All devices specified herein shall conform to the requirements of the Contract Documents.

2.2 MOTOR CURRENT DETECTION SWITCH

A. Current switches are used to detect motor current and indicate motor running status.

B. CHARACTARISTICS:

1. The current sensor shall induce power from the monitored load.

2. The current sensor shall provide on/off status indication of electrical loads from 0.25 to 200 A.

3. The current sensor shall have an auto adjusting operating range from 0.25 to 200 A.

4. The current sensor trip point shall be fixed at 0.25 A or below.

5. The current sensor shall be capable of providing accurate status at temperatures from -15° to 60°C.

6. The current sensor shall be isolated to 600 VAC RMS.

7. The current sensor output shall be N.O., solid state, 1.0 A @ 30 VAC/DC

8. The current sensor shall be a solid-core.

9. The current sensor shall have a mounting bracket with adjustable positioning.

C. MANUFACTURER: Switches shall be as manufactured by:

1. Veris industries H800
2. ENGINEER approved equal.

D. SCOPE OF SUPPLY

1. See instrument list in section 40 91 00.

PART 3 EXECUTION

3.1 GENERAL:

A. Installation and wiring shall be per manufacturer's requirements.

END OF SECTION

SECTION 40 91 23 - FLOW PROCESS MEASUREMENT DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes flow rate measurement devices, including sensors, indicators, transmitters, recorders, and integrators. Flow meter types that are covered in this Section are magnetic.

B. Section Includes:

1. Magnetic flow meters.
2. Transmitters.
3. Indicators.

C. Related Requirements:

1. Section 01 33 00, Submittal Procedures
2. Section 40 05 13, Common Work Results for Process Piping

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.

B. ASTM International:

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings.

C. American Water Works Association:

1. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4-inch Through 144-inch.

2. AWWA Manual M6 - Water Meters-Selection, Installation, Testing, And Maintenance.

D. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 COORDINATION

A. Coordinate Work of this Section with pump station upgrades to suit Project needs.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's Product Data for system materials and component equipment, including connection requirements.

C. Shop Drawings:

1. Indicate system materials and component equipment.
2. Wiring diagrams and electrical data.
3. Submit installation requirements and other details.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manual: Complete operation and maintenance instructions for metering systems, including relevant instrumentation and controls.

F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections.

H. Manufacturer Reports:

1. Certify that equipment has been installed according to manufacturer's instructions.

2. Indicate activities on Site, adverse findings, and recommendations.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

B. Tools: Furnish special wrenches and/or other specialty devices required for OWNER to maintain devices.

1.7 QUALITY ASSURANCE

A. Ensure materials of construction of wetted parts are compatible with process liquid.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept equipment on Site in manufacturer's original packaging and inspect for damage.

B. Store equipment according to manufacturer's instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from areas involved in construction operations.

2. Provide additional protection according to manufacturer's instructions.

1.9 CLEANUP

A. Prior to final acceptance, remove all debris from the site. Clean all meters, controls, cabinets, and other metering appurtenances.

1.10 WARRANTY

A. Furnish One-year manufacturer's warranty for flow measurement devices.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Furnish all materials, as required, for application as specified herein.

2.2 MAGNETIC FLOW METERS

A. Manufacturers:

1. Endress Hauser Promag W 400 0xDN, or equal

B. Description: Low-frequency, electromagnetic induction-type flow meter, producing a linear signal directly proportional to flow rate, consisting of flow tube, signal cable, and transmitter.

C. Minimum Flow Rate Range: 0 to 2,000 gpm

D. Size: As indicated on Drawings.

E. Full Bore flow tube suitable for use with zero upstream or downstream straight run installation.

F. Flow Tubes:

1. Material: Type 304 or 316 stainless steel, with polyurethane liner.

2. End Connections:

a. Flanged, ASME B16.1, Class 150, carbon steel.
b. As specified in Section 40 05 13 - Common Work Results for Process Piping.

G. Electrodes:

1. Type 316L stainless steel.
2. Self-cleaning.

H. Outputs: Isolated outputs shall be 4-20 mA dc plus two digital outputs.

I. Sensor Housing: Rated for NEMA 6/IP67 for submergence conditions for below grade or vault installation.

J. Body Coating: Epoxy applied by manufacturer per AWWA C550

K. Flow Measurement:

1. Uni-directional.
2. Accuracy: Plus or minus 1 percent of actual flow rate over a 10:1 range.
3. Repeatability: ± 0.1% of range
4. Provide adjustment for zero and span.

L. Function as specified herein at temperatures between - 5 ºF and 140 ºF and when submerged below 10 feet of water on an occasional basis.

M. Hazardous Area Classification

1. Class 1, Division 2, Groups B, C.

N. Accessories:

1. Furnish cable between the transmitter and receiver.
2. Spool grounding kit and/or ground rings as required by manufacturer.

2.3 TRANSMITTERS

A. Transmitter Output:

1. 4 to 20 mA dc analog signal.
2. Accuracy: Plus or minus 1 percent of full scale.

B. Housing: NEMA 6P/IP68.

C. HMI:

1. Touch-screen programming, functioning through enclosure window without opening enclosure.

2. Display:

a. Size: Four lines by 16 characters.
b. Type: Backlit LCD.
c. User-selectable engineering units.
d. Readout of diagnostic error messages.

D. Mounting:

1. Remote or integral transmitter mounting as indicated in plans and specifications.

E. Transmitter Communication Interface: Digital HART

F. Accessories:

1. Current signal output simulation.

2. Empty pipe detection.

3. Self-diagnostics.

4. Automatic zero adjustment.

5. Stainless-steel sunshield for outdoor installations.

6. Signal Cable: Provided by flow meter manufacturer.

a. Cable:

1) 1/2-inch diameter, NPT connections.

2) Provide in a single length to meet requirements shown in Drawings. No splicing of cables will be allowed. Include cable length in Shop Drawings.

2.4 OPERATION

A. Control Power:

1. Provide with wide range power.

a. AC 100 to 240 V.
b. AC/DC24 V.

2.5 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of meters according to AWWA Manual M6.

B. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION

A. Coordinate location and orientation of flow meter with final equipment installations.

B. Ensure that instruments are located to be easily accessible for maintenance.

C. Installation and wiring shall be per manufacture’s requirements.

D. If physical space permits, maintain a minimum of 5x pipe diameters length of straight pipe upstream of the meter and a minimum of 2x pipe diameters length of straight pipe downstream of the meter. Install as indicated on mechanical/piping plans.

3.3 FIELD QUALITY CONTROL

A. Testing:

1. Configure and Test flow meter to demonstrate that it meets specified accuracy requirements.

2. Comply with AWWA Manual M6.

B. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified, and rerun tests.

2. Make final adjustments to equipment under direction of manufacturer's representative.

3.4 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to OWNER's personnel.

3.5 SCOPE OF SUPPLY

A. See instrument list located in section 40 91 00 2.1.A.

END OF SECTION

SECTION 40 92 00 - CONTROL PANELS AND COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes requirements for:

1. Fabrication and assembly of all instrumentation enclosures, control panels and components provided under this contract, including but not limited to:

a. Custom built instrumentation and SCADA Control Panels, including, Remote Telemetry Units (RTU), Master Telemetry Units (MTU) and Local Control Panels (LCP).

b. Control components.

B. Related Sections:

1. The Contract Documents are a single integrated document, and as such all divisions and sections apply. It is the responsibility of the CONTRACTOR and its Subcontractors to review all sections to ensure a complete and coordinated project.

1.2 REFERENCES, SPECIFICATIONS AND CODES

A. Control panels shall comply with the requirements of NEC, NEMA and UL.

1.3 DEFINITIONS

A. Specific Definitions:

1. The term "panel" in this Section is interchangeable with the term "enclosure."

1.4 SYSTEM DESCRIPTION

A. Panel Dimensions:

1. Minimum dimensions are scalable from or as indicated on Drawings and are based upon manufacturer's noncertified information. It is the responsibility of the CONTRACTOR or manufacturer to design and size all panels:

a. Size panels to provide space for all equipment, wiring, terminations, and other items in the panel, including space for future build out.

b. Maximum Panel Depth:

1) 24 inches, unless otherwise indicated.

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00, Submittal Procedures

B. Provide a control panel submittal, for each control panel and enclosure being provided on this project, including but not limited to:

1. Product Data:

a. Enclosure construction details and NEMA type.

b. Manufacturer's literature and specification data sheets for each type of equipment to be installed within or on the panel or enclosure clearly marked to show model and options for selected component.

2. Shop Drawings:

a. Scaled, detailed exterior panel (front and side views) and interior panel layout showing equipment arrangement and dimensional information

b. Detailed control wiring schematics including control power distribution, IO wiring, networks etc.

c. Complete nameplate engraving schedule.

d. Structural details of fabricated panels.

3. Complete and Detailed Bills of Materials:

a. A bill of material list, including quantity, description, manufacturer, part number, serial number, vendor name and spare part list where required, shall be submitted for each of the PCIS system components. Bills of material shall include all items within an enclosure.

b. Provide the bill of material on CD-ROM in Microsoft Excel format.

4. Calculations:

a. For assembled enclosures, provide calculations for:

1) Expected temperature rise inside enclosure
2) Expected duration of up time for back up power system (UPS or battery).
3) Approximate wire duct percent fill.

1.6 QUALITY ASSURANCE

A. Assemble panels, enclosures, and rack systems along with all internal and external devices, wiring, equipment, and materials in a facility that is recognized by Underwriters Laboratories to assemble and certify UL-labeled control panels:

1. Provide all components and equipment with UL 508 listing.

2. All control panels shall be labeled as follows, unless the equipment in the panel and the design in the Contract Documents cannot be reasonably modified to meet the requirements for the specified labeling:

a. UL 508A for general control panels not in hazardous locations.

b. UL 698 for control panels in hazardous locations.

c. UL 698A for control panels not in hazardous locations but contain intrinsically safe barriers for devices located in hazardous locations.

B. Nonlisted, complex and unique equipment may be evaluated and approved by a third party testing agency, with prior approval by the Owner. Provide report documenting the testing standard, specification, method of testing and that the equipment and materials meet appropriate designated standards or have been tested and found suitable for use in a specified manner.

1. Provide fuses for all equipment that is not UL listed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Crate all panels for shipment using a heavy framework and skids:

1. Provide wrapped waterproof flexible material for covering materials, where applicable, to protect against physical damage in transit.

2. Provide suitable shipping stops and cushioning material for all instruments shipped with the panel to prevent damage due to mechanical shock during shipment.

3. For large panels, provide removable lifting lugs to facilitate handling.

1.8 PROJECT SITE CONDITIONS

A. Provide enclosures suitable for the location and environmental conditions in which they are located, and in the NEMA types in accordance with project specifications and drawings.

1.9 WARRANTY

A. One Year Warranty from time of Delivery and Acceptance.

PART 2 PRODUCTS

2.1 GENERAL

A. The CONTRACTOR shall provide the stations to satisfy the functional requirements in the relevant mechanical equipment and instrumentation and control specifications. Each station shall be fabricated with UL labeled components.

B. The controls shall be 120 V maximum. Where the electrical power supply is 240 V, single phase or 480 V, 3 phase, the system shall be provided with a fused control power transformer.

C. Each panel shall be provided with identified terminal strips for the connection of external conductors. The CONTRACTOR shall provide sufficient terminal blocks to connect 25 percent additional conductors for future use.

D. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.

E. Enclosures

1. Enclosures shall be NEMA 4X stainless steel for outdoor, corrosive or wet areas.

2. Enclosures, shall be NEMA 12 for dry indoor, non corrosive areas.

3. Outdoor mounted panels shall be provided with thermostatically controlled heaters.

4. Provide screened weep holes for draining condensation.

2.2 MANUFACTURERS

A. As listed below in the individual component paragraphs.

B. Provide instruments and other components performing similar functions of the same type, model, or class, and from one manufacturer.

2.3 MATERIALS

A. Construct and finish enclosures using materials capable of withstanding the mechanical, electrical, and thermal stresses, as well as the effects of humidity and corrosion that are likely to be encountered in normal service:

1. Enclosures shall be NEMA 250 type as indicated in Panel Drawings.

2. Enclosures shall have the following properties:

a. NEMA I:

1) Steel.

b. NEMA 4:

1) Steel with gasketed door, rain tight.

c. NEMA 4X:

1) Stainless steel Type 316 (unless indicated Type 304 on Drawings).

d. NEMA 12:

1) Steel with gasketed door, dust-tight.

e. NEMA 7:

1) Cast aluminum.

B. Bolting Material:

1. Commercial quality 1/2-inch diameter, stainless steel hex-head grade five bolts, nuts and washers, with unified coarse (UNC) threads.

2. Carriage bolts for attaching end plates.

3. All other bolted joints shall have S.A.E. standard lock washers.

2.4 MANUFACTURED UNITS

A. Panels/Enclosures:

1. Manufacturers:

a. Hoffman Engineering or equal.

2. Panel Assembly:

a. General guidelines for panel fabrication include:

1) Continuous welds ground smooth.

2) Exposed surfaces free of burrs and sharp edges.

3) Base formed of heavy channel iron, either galvanized or powder coated, minimum 1/2-inch holes at 12-inch spacing to accommodate anchoring of freestanding enclosures to floor.

b. Construct enclosure and mounting panel using stretcher level sheet metal having minimum thickness not less than the following sizes (U.S. Standard Gauge):

1) Use heavier sheet metal to meet seismic requirements at the Project Site or when required due to equipment requirements.

Enclosure Height (inches)	Minimum Enclosure Steel Thickness	Minimum Back Mounting Panel Thickness
Up to 57	12	12
57-69	12	10
69-82	12 except 10 on back	10
82 or more	10	10

c. Construct supporting frame structure with angled, channeled, or folded rigid section of sheet metal, rigidly attached to and having essentially the same outer dimensions as the enclosure surface and having sufficient torsional rigidity to resist the bending moments applied via the enclosure surface when it is deflected.

d. Provide stiffeners for back mounting panels in enclosures larger than 4 feet. In addition, secure the panels in place by collar studs welded to the enclosure.

e. Door Construction:

1) Turned-back edges suitably braced and supported to maintain alignment and rigidity without sagging.

a) Sufficient width to permit door opening without interference with rear projection of flush mounted instruments.

b) Heavy gauge piano type continuous stainless steel hinges.

c) For NEMA 12, 4 and 4X, provide oil resistant neoprene sealing gasket and adhesive to seal cover to enclosure.

d) Gasket installed to seal against roll lip on the enclosure opening.

2) Latches:

a) For panels each door provided with a three-point latching mechanism and locking handle with rollers on the ends of the latch rods. Latch rods connected to a common door handle, hold doors securely, forming a

compressed seal between door and gasket, at the top, side, and bottom.

(1) Provide padlock for each enclosure with padlock provisions.

3) Include an oil-tight key-locking, three-point latching mechanism on each door:

a) Provide two keys per panel.
b) All locks keyed the same.

4) For large type NEMA 4 and NEMA 4X cabinets, not available with three-point latching hardware, provide multiple clips and padlock hasps.

5) Provide quick release latches for all NEMA 4 and 4X enclosures.

6) Panel Cut-Outs:

a) Cut, punch, or drill cutouts for instruments, devices, and windows. Smoothly finish with rounded edges.

b) Allow a minimum of 3-inch envelope around all displays, controllers, and monitors.

c) Reinforce around cut-outs with steel angles or flat bars for the following:

(1) Large panel cutouts; for example, openings for local operator interfaces.

(2) Pilot device groupings, where the removed metal exceeds 50 percent of the available metal.

B. Outdoor Panels. Supplementary requirements for panels located outdoors are as follows:

1. All enclosures located outdoors shall be explicitly designed and rated for outdoor service by the manufacturer.

2. Bases: Heavy channel, gasketed iron bases, flanges up, for anchoring to pad.

3. Provide exterior drip edge for top of door frame.

4. Provide thermostatically controlled heater.

C. Arrangement of Components:

1. Arrange panel internal components for external conduit and piping to enter into panel either from above or below.

2. Arrange panel instruments and control devices in a logical configuration associating pushbutton and selector switches with related readout devices.

3. Mount internal control components on an internal back-panel. Devices may be mounted on the side-panel only by special permission from the Engineer.

4. All control panel mounted operator interface devices shall be mounted between 4 feet and 6 feet above finished floor.

D. Disconnect Switches

1. See over current protection below.

E. Over Current Protection:

1. Main over current Device:

a. Where the electrical power supply voltage to the control panel is more than 120V ac, provide the panel with a flange mounted disconnect handle operating a molded case circuit breaker, and provide a control power transformer for 120V ac circuits:

1) Mechanically interlocked the disconnect switch with the control enclosure doors so that no door can be opened unless the power is disconnected, and the disconnect switch cannot be closed until all doors are closed.

2) Disconnect switch shall be lockable in the OFF position.

3) Provide means to defeat the interlock.

4) Disconnect switches shall be heavy duty, fusible, single throw. Fuses shall be provided.

b. Control Panels Supplied with 120V ac:

1) Provide an internal breaker with the line side terminals covered by a barrier.

2) Provide a nameplate prominently positioned on the control panel identifying the location of the power source and a warning statement requiring the source to be disconnected before opening the door to the enclosure.

2. Selection and Ratings of Protective Devices:

a. Interrupting Ratings: Not less than the system maximum available fault current at the point of application.

b. Voltage Rating: Not less than the voltage of the application.

c. Select current rating and trip characteristics to be suitable for:

1) Maximum normal operating current.

2) Inrush characteristics.

3) Coordination of the protective devices to each other and to the source breaker feeding the panel.

3. Provide a separate protective device for each powered electrical device:

a. An individual circuit breaker for each 120V ac instrument installed within its respective control panel and clearly identified for function.

b. An individual fuse for each PLC discrete output. Provide with individual fuse with blown fuse indication external of the I/O card:

1) Size external fuse to open before any I/O card mounted fuses.

2) An individual fuse for each discrete input loop.

3) An individual 1/2-amepre fuse for each 4 to 20 mA analog loop powered from the control panel.

4) Install protective devices on the back mounting panel and identify by a service nameplate in accordance with the wiring diagrams.

4. Control Circuit Breakers

a. DIN Rail Mounting on 35mm rail

b. Manual OPEN-CLOSE toggle switch

c. Rated 250 VAC

d. Interrupting Rating:

1) 10kA or available fault current at the line terminal, whichever is higher

e. Current ratings:

1) As required for the application.

5. Fuse Holders:

a. Fused Terminal Blocks

b. DIN Rail mounting on 35mm rail

c. Suitable for specified AWG wire

d. Rated for 10 amperes at 600 volts

e. Screw terminal type

f. 8mm

g. Finger safe protection for all terminals for conductors

h. Terminals:

1) Plainly identified to correspond with markings on the diagrams. Permanent machine printed terminal identification.

i. Wire size 22-12 AWG

j. Color:

1) Grey

k. Indication:

1) 120VAC NEON

l. Indication:

1) 24VDC LED

F. Conductors and Cables:

1. Power and Control Wiring:

a. Materials:

1) Stranded, soft annealed copper.

b. Insulation:

1) 600-volt Type MTW.

c. Minimum Sizes:

1) Primary Power Distribution:

a) 12 AWG.

2) Secondary Power Distribution:

a) 14 AWG.

3) Control:

a) 16 AWG.

d. Color:

1) ac Power (Line and Load):

a) Black.

2) ac Power (Neutral):

a) White.

3) ac Control:

a) Red.

4) dc Power and Control:

a) Blue.

5) dc Power common white with blue stripe

6) Ground:

a) Green.

G. Signal Cables:

1. Materials:

a. Stranded, soft annealed copper.

2. Insulation:

a. 600-volt, PVC outer jacket.

3. Minimum Size:

a. 18 AWG paired.

4. Overall aluminum shield (tape).

5. Copper drain wire.

6. Color:

a. Two Conductors:

1) Positive (+): White, red.
2) Negative (-): Black.

b. Three Conductors:

1) Positive (+): White.
2) Negative (-): Black.
3) Signal: Red.

c. Insulate the foil shielding and exposed drain wire for each signal cable with heat shrink tubing.

H. Conductor Identification:

1. Identify all conductors and cables with wire markers.
2. Readily identified without twisting the conductor.

I. General Wiring Requirements:

1. Wiring Methods:

a. Wiring methods and materials for panels shall be in accordance with the NEC requirements for General Purpose (no open wiring) unless otherwise specified.

2. Install all components in accordance with the manufacturer's instructions included in the listing and labeling.

3. Where the electrical power supply voltage to the control panel is more than 120V ac, provide the panel with a flange mounted disconnect and control power transformer. Mechanically interlocked the disconnect switch with the control enclosure doors so that no door can be opened unless the power is disconnected, and the disconnect cannot be closed until all doors are closed.

a. Provide means to defeat this interlock.

4. Control panels supplied with 120V ac:

a. Provide an internal breaker with the line side terminals covered by a barrier.

b. Provide a nameplate prominently positioned on the control panel identifying the location of the power source and a warning statement requiring the source to be disconnected before opening the door to the enclosure.

5. Provide a nameplate on the cover of the control panel identifying all sources of power supply and foreign voltages within the control panel.

6. Provide transformers, protective devices, and power supplies required to convert the supply voltage to the needed utilization voltage.

7. Provide surge protection device on input supply power.

8. Provide nonmetallic ducts for routing and organization of conductors and cables:

    a. Size ducts for ultimate build-out of the panel, or for 25 percent spare, whichever is greater.

9. Cables shall be fastened with cable mounting clamps or with cable ties supported by any of the following methods:

    a. Screw-on cable tie mounts.
    b. Hammer-on cable tie mounting clips.
    c. Fingers of the nonmetallic duct.

10. The free ends of cable ties shall be cut flush after final adjustment and fastening.

11. Provide supports at the ends of cables to prevent mechanical stresses at the termination of conductors.

12. Support panel conductors where necessary to keep them in place.

13. Wiring to rear terminals on panel-mount instruments shall be run in nonmetallic duct secured to horizontal brackets run adjacent to the instruments.

14. Conductors and cables shall be run from terminal to terminal without splice or joints.

    a. Exceptions:

        1) Factory applied connectors molded onto cables shall be permitted. Such connectors shall not be considered as splices or joints.

15. The control panel shall be the source of power for all 120V ac devices interconnected with the control panel including, but not limited to:

    a. Instruments and both mounted in the control panel and remotely connected to the control panel.

    b. Solenoid Valves

2.5 PANEL COMPONENTS

A. Pilot Devices:

1. General:

    a. Provide operator pushbuttons, switches, and pilot lights, from a single manufacturer.

b. Size:

1) 30.5 mm.

c. Heavy duty oil tight.

d. Pushbuttons:

1) Contacts Rated: NEMA A600.

2) Furnish one spare normally open and normally closed contact with each switch.

e. Selector Switches:

1) Contacts Rated:

a) NEMA A600.

2) Knob type.

3) Furnish one spare normally open contact and normally closed contact with each switch.

4) Provisions for locking in the OFF position where lockout provisions are indicated.

f. E-Stop Pushbuttons

1) Maintained position
2) Mushroom head
3) Red color.

g. Pilot Lights:

1) Type:

a) LED

2) Push to Test.

3) Lamp Color:

a) On/Running/Start:

(1) Red.

b) On Forward:

(1) Red.

c) On Reverse:

(1) Red.

d) Off/Stop:

(1) Green.

e) Power:

(1) White.

f) Ready:

(1) White.

g) Alarm/Failure:

(1) Amber.

h) Opened:

(1) Red.

i) Closed:

(1) Green.

j) Auto:

(1) White.

k) Manual:

(1) Amber.

l) Local:

(1) White.

m) Remote:

(1) Amber.

2. Indoor and Outdoor Areas:

    a. NEMA Type 4/13.

    b. Manufacturers and Products: One of the following:

        1) Allen-Bradley; Type 800T or equal.

3. Corrosive Areas:

    a. NEMA 4X.

    b. Corrosion resistant.

    c. Exterior parts of high impact strength fiberglass reinforced polyester or multiple-layer epoxy coated zinc.

    d. Manufacturers and Products: One of the following: Allen-Bradley; Type 800H or equal.

4. Hazardous (Classified) Areas/Class 1 Division 2:

    a. NEMA 4X.

    b. Corrosion resistant.

    c. Exterior parts of high impact strength fiberglass reinforced polyester or multiple-layer epoxy coated zinc:

        1) All contacts contained within a hermetically sealed chamber:

            a) Pushbuttons.
            b) Selector switches.
            c) Push-to-test contacts on pilot lights.

        2) UL listed and labeled for Class I Division 2 areas.

            a) Manufacturers and Products: One of the following:

        3) Allen-Bradley; Type 8001-1 or equal.

B. Signal Isolators and Converters:

1. Furnish signal isolators that provide complete isolation of input, output, and power input:

a. Minimum Isolation Level:

1) 1.5 kV ac/50-Hz for at least 1 minute.

b. Adjustable span and zero.

c. Accuracy:

1) Plus or minus 1 percent of span.

d. Ambient Temperature Range:

1) Minus 20 degrees C to plus 65 degrees C.

2. Manufacturers and Products:

a. One of the following:
b. Phoenix Contact; MCR Series or equal.

C. Relays:

1. General:

a. For all types of 120V ac relays, provide transient surge protection across the coil of each relay.

b. For all types of 24V dc relays, provide a free-wheeling diode across the coil of each relay.

2. General Purpose:

a. Magnetic control relays.

b. NEMA A300 Rated:

1) 300 volts.
2) 10 amps continuous.
3) 7,200 VA make.
4) 720 VA break.

c. Plug-in type.

d. LED indication for relay energized.

e. Coil Voltages:

    1) As required for the application.

f. Minimum Poles:

    1) 3PDT.

g. Touch Safe Design:

    1) All connection terminals to be protected against accidental touch.

h. Enclose each relay in a clear plastic heat and shock-resistant dust cover.

i. Quantity and type of contact shall be as shown on Drawings or as needed for system compatibility.

j. Relays with screw-type socket terminals.

k. Provide additional (slave/interposing) relays when the following occurs:

    1) The number or type of contacts shown exceeds the contact capacity of the specified relays.

    2) Higher contact rating is required in order to interface with starter circuits or other equipment.

l. DIN rail mounting on 35-mm rail.

m. Ice cube type relays shall be provided with retainer clips to secure relay in socket.

n. Integrated label holder for device labeling.

o. Manufacturers and Products:

    1) One of the following:

        a) Phoenix Contact; PLC series.
        b) Potter and Brumfield; Type KRP or KUP.
        c) IDEC; R* Series (* = H, J, R, S, U).
        d) Allen-Bradley; Type 700 H Series.
        e) Square D; Type K.

3. Terminal Block Relays

    a. DIN Rail Mounting on 35mm rail

    b. Magnetic control relays

    c. NEMA Rated:

        1) B300/R300

    d. Electromechanical relay interchangeable with solid state relays

    e. Plug-in type

    f. LED coil indication

    g. Coil voltages:

        1) as required by application

    h. Screw type socket terminals

    i. Poles:

        1) single pole, double throw

    j. Integrated label holder for device labeling

    k. Touch safe design. All connection terminals to be protected against accidental touch

    l. Quantity and type of contact shall be as shown on Drawings or as needed for system compatibility

    m. Manufacturers and Products:

        1) Allen-Bradley 700 series or equal.

4. Time Delay:

    a. Provide time delay relays to control contact transition time.

    b. Contact Rating:

        1) 240 volts.
        2) 10 amps continuous.
        3) 3,600 VA make.
        4) 360 VA break.

c. Coil Voltage:

1) As required for the application.

d. Provide pneumatic or electronic type with on-delay, off-delay, and on/off delay:

1) For off delay use the power off time delay relays. Where the required timing range exceeds capability of the off delay relay use signal off delay where power loss will not cause undesirable operation or pneumatic time delay relays.

e. Minimum Poles:

1) 2PDT.

f. Units include adjustable dial with graduated scale covering the time range in each case.

g. Minimum Timing Range:

1) 0.1 second to 10 minutes, or as required for the application.

h. Manufacturers and Products:

1) One of the following:

a) lDEC; GT3 series.
b) Agastat Type; Series 7000 Series (Pneumatic).
c) Allen-Bradley; Type 700 HR Series.
d) Or equal.

D. Magnetic starters shall be:

1. NEMA, IEC or dual NEMA/IEC rated

2. FVNR type unless indicated otherwise

3. Combination starters with magnetic only instantaneous trip circuit breakers such as Eaton Electrical MCP, G.E. Mag-Break, or equal.

E. Terminal Blocks:

1. Din rail mounting on 35-mm rail.

2. Suitable for specified AWG wire.

3. Rated for 30 amperes at 600 volts.

4. Screw terminal type.

5. Provide mechanism to prevent wire connection from loosening in environments where vibration is present. This mechanism shall not cause permanent deformation to the metal body.

6. Finger safe protection for all terminals for conductors.

7. Construction:

    a. Polyamide insulation material capable of withstanding temperature extremes from minus 40 degrees C to 105 degrees C.

8. Terminals:

    a. Plainly identified to correspond with markings on the diagrams:

        1) Permanent machine printed terminal identification.

        2) Disconnect type field signal conductor terminals with socket/screw for testing.

        3) Identify terminals suitable for use with more than one conductor.

        4) Position:

            a) So that the internal and external wiring does not cross. To provide unobstructed access to the terminals and their conductors.

        5) Provide minimum 25 percent spare terminals.

        6) Manufacturers:

            a) Entrelec or equal.

9. Fuses (Holders) and Circuit Breakers:

    a. Fuse Holders:

        1) Modular Type:

            a) DIN rail mounting on 35-mm rail.

            b) Touch Safe Design:

                (1) All connection terminals to be protected against accidental touch.

            c) Incorporates blown fuse indicator.

2) Provide Nameplate Identifying each Fuse.

3) Manufacturers:

a) Entrelec or equal.

F. Power Supplies:

1. Design power supply systems so that either the primary or backup supply can be removed, repaired, and returned to service without disrupting the system operation.

2. Convert 120V ac to 24V dc or other dc voltages as required for the application.

3. Provide backup 24V dc power supply units to automatically supply the load upon failure of the primary supply.

4. Provide power supply arrangement that is configured with several modules to supply adequate power in the event of a single module failure:

5. Provide Automatic switchover upon module failure.

6. Alarm contacts monitored by the PLC.

7. Sized to provide 40 percent excess rated capacity.

8. UL 508C listed to allow full rated output without de-rating.

9. Provide fuse or short-circuit protection.

10. Provide a minimum of one set of dry contacts configured to change state on failure for monitoring and signaling purposes.

11. Output Regulation:

a. Plus or minus 0.05 percent for a 10 percent line change or a 50 percent load change: With remote voltage sensing.

12. Operating Temperature Range:

a. 0 to 50 degrees C.

13. DIN rail mounting on 35-mm rail.

14. Provide self-protecting power supplies with a means of limiting de current in case of short circuit.

15. Manufacturer:

    a. Sola or equal.

G. Industrial Ethernet Switches:

1. IP Ethernet switch

2. Four 100/100BaseTX RJ-45 Ports or more as needed

3. -40C to 70C Operating temperature range

4. Auto sensing 10/100BaseTX

5. DIN rail mountable enclosure

6. 24VDC Input voltage

7. Include minimum of one 1000BaseSX Multimode GB Fiber Optic Port (LC Connector) only as needed or required by project drawings.

8. Manufacturer N-Tron or equal

H. Wire Duct:

1. Provide flame retardant plastic wiring duct, slotted with dust cover.

2. Type:

    a. Wide slot.
    b. Narrow slot.
    c. Round hole.

3. Manufacturer: Panduit or equal

2.6 ACCESSORIES

A. Provide panels with an inside protective pocket to hold the panel drawings. Ship panels with one copy of accepted Shop Drawings including, but not limited to, schematic diagram, connection diagram, and layout drawing of control wiring and components in a sealed plastic bag stored in the panel drawing pocket.

1. Provide 15-inch floor stands or legs where needed or as indicated in specifications.

2. Provide a folding shelf for enclosures that contain programmable controllers. The shelf shall be mounted on the inside surface of the door, capable of supporting a laptop computer.

3. Provide nameplate to each panel as indicated on Drawings.

B. Provide a nameplate with the following markings that is plainly visible after installation:

1. Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the panel can be identified.

2. Supply voltage, phase, frequency, and full-load current.

3. Short-circuit current rating of the panel based on one of the following:

a. Short-circuit current rating of a listed and labeled assembly.
b. Short-circuit current rating established utilizing an approved method.

C. Lighting:

1. Provide one luminaire for each section, on the interior of the panel, spaced evenly along the top-front of the enclosure door opening(s):

2. Covered or guarded.

3. Provide on-off door-activated switches where indicated on Drawings.

4. Provide 5-watt, 400 lumen LED lamp for indoor enclosures less than 36 inches wide.

5. Provide two 5-watt, 400 lumen LED lamps for enclosures larger than 36 inches wide.

D. Receptacles:

1. Provide one convenience duplex receptacle located every 4 feet of enclosure width, spaced evenly along the back mounting panels.

a. GFCI, 125-volt, single-phase, 15-ampere.

2. Power receptacles used for control power or UPS power circuit:

a. Non GFCI, 125-volt, single-phase, 15-ampere.

E. Grounding: Provide the following:

1. Grounding strap between enclosure doors and the enclosure.

2. Equipment grounding conductor terminals.

3. Provide equipment ground bus with lugs for connection of all equipment grounding wires.

4. Bond multi-section panels together with an equipment grounding conductor or an equivalent grounding bus.

5. Identify equipment grounding conductor terminals with the word "GROUND", the letters "GND" or the letter "G," or the color green.

6. Signal (24V dc) Grounding: Terminate each drain wire of a signal (shielded) cable to a unique grounding terminal block, or common ground bus at the end of the cable as shown on the loop drawings.

7. Ensure the continuity of the equipment grounding system by effective connections through conductors or structural members.

8. Design so that removing a device does not interrupt the continuity of the equipment grounding circuit.

9. Provide an equipment-grounding terminal for each incoming power circuit, near the phase conductor terminal.

10. Size ground wires in accordance with NEC and UL standards, unless noted otherwise.

11. Connect all exposed, noncurrent-carrying conductive parts, devices, and equipment to the equipment grounding circuit.

2.7 SPARE PARTS

A. Provide a minimum of 10 percent spare lamps (minimum 2) and one spare lens for each color pilot lamp in each panel.

PART 3 EXECUTION

3.1 CALIBRATION AND TESTING

A. GENERAL:

1. Calibration and testing shall be performed in accordance with Section 409100

2. TESTING:

a. Panel fabricator shall conduct the following test prior to panel shipment:

1) Check panel power distribution such that the indicated fuse or circuit breaker in fact provides power to devices indicated on wiring schematics.

2) Check for proper fuse and circuit breaker size.

3) Power up all devices in the control panel to check for proper operation.

4) Test for correct operation and indication of all selector switches, push buttons and indicator lights.

5) Verify proper operation of variable frequency drives as well as correct response to remote speed control signal and speed feedback signal.

6) Verify correct operation and settings of timing relays.

7) Test all PLC digital inputs for proper operation from the field IO terminal block all the way to the PLC.

8) Test all PLC analog inputs for proper operation from the field IO terminal block all the way to the PLC. Analog inputs shall be tested using a 4-20mA or 0-10VDC signal source to verify input signals at 25, 50, 75 and 100% of full scale.

9) Test all PLC digital outputs for proper operation from the PLC to the field terminals, including any interposing relays in the output circuit.

10) Test all PLC analog output for proper operation from the field IO terminal block all the way to the PLC. Analog outputs shall be verified using a multimeter at 25, 50, 75 and 100% of full scale.

11) Check Ethernet network connections and switch operation.

B. TEST REPORT:

1. The CONTRACTOR shall provide a test report detailing the test procedure and results of the testing conducted according to section B above.

END OF SECTION

SECTION 40 93 00 - CONTROL STRATEGY

PART 1 GENERAL

1.1 THE REQUIREMENT

A. GENERAL:

1. The client or client representative shall provide all control system PLC and HMI programming for pump stations.

B. Control programs shall function normally in the absence of and HMI station without modifications. Process control logic and alarm functions shall be implemented at the PLC/controller level only.

PART 2 CONTROL STRATEGIES

2.1 SOUTH WELCHES PUMP STATION CONTROL STRATEGY

A. Process Description

1. There are 2 pumps in South Welches pump station that pump collected wastewater to the treatment system. The pumps shall operate on a lead, lag configuration to maintain level in the collection wet well and deliver water to the treatment plant. The operator shall select the pump lead/lag role for each pump. The lead pump shall start and run when the wet well rises above the predetermined lead start level set point. If the level continues to rise above the lag start set point the lag pump shall start after a predetermined time delay. When the well level falls below the lag stop set point for a predetermined time, the lag pump shall stop. The lead pump shall stop if the level falls below the lead stop set point. If the lead pump fails or becomes unavailable, the system shall automatically rotate the pump roles so the lead becomes backup, lag becomes lead and backup becomes lag. The lead/lag pump selection shall rotate at the end of each pump down cycle in order to equalize runtime on each pump.

2. Wet Well Level Selection: The station has redundant level sensors. The higher of two level readings shall be automatically selected for control as long as both sensors are healthy. If one sensor fails (reading out of range), the other sensor shall be selected for control. If both sensors fail, the level process variable shall be set to zero. In this scenario, the station shall operate on backup float control.

B. P&ID: 2A-IC1

C. Equipment

1. Pump 1
2. Pump 2
3. Wet Well Level 1
4. Wet Well Level 2
5. Wet Well High Level Float
6. Wet Well High High Level float
7. Wet Well Overflow Float

D. Local Mode

1. Each pump may be run manually using local controls located on the individual MCC bucket by placing the HAND/OFF/AUTO selector switch in the HAND position. The pump speed can be adjusted locally at the variable frequency drive (VFD) control face plate. The pump will operate continuously until the operator places the selector switch into the OFF position. Manual operation overrides all software interlocks.

E. Remote Manual Mode

1. Each pump that is placed in Auto mode at the MCC bucket selector switch can be run in Manual from the HMI. When the Hand-Off-Auto switch is in auto and the pump is in manual at the HMI, the operator can start/stop the pump using HMI controls.

F. Remote Auto Mode

1. Remote Auto Prerequisites: The pumps can be operated in remote auto mode by placing the MCC bucket selector switches in the Auto position and putting each pump in auto mode via the HMI interface. In auto mode the pumps will operate in a lead, lag mode. An automatic pumping cycle will begin when the level in the wet well rises above the start pump set point. The automatic mode sequence is discussed in section 2.1.A.1 above

2. Float Backup: In any mode, if the wet well level rises and triggers the high level float pump 1 will start and run at a full speed for a predetermined duration. The duration of the pump run will be set (via timing relay in the control panel) to ensure that the pump does not run dry. If the level in the wet well rises high enough to trigger the high high float, pump 2 will be started and run at full speed for a predetermined duration. Each high float in the wet well will be directly linked to one pump to provide independent redundant pump backup operation. Operation of the float backup system is independent of the PLC and will function even when the normal control system is not operating.

3. Operator Inputs: The operator must set the following parameters in the system for automatic mode:

a. Wet well lead start pump level set point
b. Wet well lead stop pump level set point
c. Wet well lag start pump level set point
d. Wet well lag stop pump level set point
e. Designate pump roles

G. Alarms:

1. Pump 1 run fail, leak, fault, over temp
2. Pump 2 run fail, leak, fault, over temp
3. Wet well high level
4. Wet well high high level
5. Wet well overflow level
6. Building intrusion
7. Control power fail
8. Utility power fail/ATS in generator position
9. Smoke alarm
10. Wet well level sensor 1 failure
11. Wet well level sensor 2 failure

H. Telemetry Alarms:

1. The following alarms shall be mapped to digital outputs on the main PLC which are wired to digital inputs on the Telemetry PLC. The telemetry PLC is already set up to send the status of 8 digital input to the Tri-City plant for alarm monitoring and notification. The alarm points at Tri-City SCADA system shall be reconfigured to match the alarms connected in the field.

a. Wet well high
b. Wet well high high level
c. Wet well overflow float
d. ATS in Generator Position
e. Control Power Fail
f. Smoke alarm
g. General pump fail
h. Generator Fault

2.2 GOLF CLUB TERRACE STATION CONTROL STRATEGY

A. Process Description

1. There are 2 pumps in Golf Club Terrace pump station that pump collected wastewater to the treatment system. The pumps shall operate on a lead, lag configuration to maintain level in the collection wet well and deliver water to the

treatment plant. The operator shall select the pump lead/lag role for each pump. The lead pump shall start and run when the wet well rises above the predetermined lead start level set point. If the level continues to rise above the lag start set point the lag pump shall start after a predetermined time delay. When the well level falls below the lag stop set point for a predetermined time, the lag pump shall stop. The lead pump shall stop if the level falls below the lead stop set point. If the lead pump fails or becomes unavailable, the system shall automatically rotate the pump roles so the lead becomes backup, lag becomes lead and backup becomes lag. The lead/lag pump selection shall rotate at the end of each pump down cycle in order to equalize runtime on each pump.

2. Wet Well Level Selection: The station has redundant level sensors. The higher of two level readings shall be automatically selected for control as long as both sensors are healthy. If one sensor fails (reading out of range), the other sensor shall be selected for control. If both sensors fail, the level process variable shall be set to zero. In this scenario, the station shall operate on backup float control.

B. P&ID: 1B-IC1

C. Equipment

1. Pump 1
2. Pump 2
3. Wet Well Level 1
4. Wet Well Level 2
5. Wet Well High Level Float
6. Wet Well High High Level float
7. Wet Well Overflow Float

D. Local Mode

1. Each pump may be run manually using local controls located on the individual MCC bucket by placing the HAND/OFF/AUTO selector switch in the HAND position. The pump will operate continuously until the operator places the selector switch into the OFF position. Manual operation overrides all software interlocks.

E. Remote Manual Mode

1. Each pump that is placed in Auto mode at the MCC bucket selector switch can be run in Manual from the HMI. When the Hand-Off-Auto switch is in auto and the pump is in manual at the HMI, the operator can start/stop the pump using HMI controls.

F. Remote Auto Mode

1. Remote Auto Prerequisites: The pumps can be operated in remote auto mode by placing the MCC bucket selector switches in the Auto position. In auto mode the pumps will operate in a lead, lag mode. An automatic pumping cycle will begin when the level in the wet well rises above the start lead pump set point. The automatic mode sequence is discussed in section 2.2.A.1 above

2. Float Backup: In any mode, if the wet well level rises and triggers the high level float, pump 1 will start and run at a full speed for a predetermined duration. The duration of the pump run will be set (via timing relay in control panel) to ensure that the pump does not run dry. If the level in the wet well rises high enough to trigger the high high float, pump 2 will be started and run at full speed for a predetermined duration. Each high float in the wet well will be directly linked to one pump to provide independent redundant pump backup operation. Operation of the float backup system is independent of the PLC and will function even when the normal control system is not operating.

3. Operator Inputs: The operator must set the following parameters in the system for automatic mode:

    a. Wet well lead start pump level set point
    b. Wet well lead stop pump level set point
    c. Wet well lag start pump level set point
    d. Wet well lag stop pump level set point
    e. Designate pump roles

G. Alarms:

1. Pump 1 run fail, leak, fault
2. Pump 2 run fail, leak, fault
3. Wet well high level
4. Wet well high high level
5. Wet well over flow level
6. Building intrusion
7. Control power fail
8. Utility power fail/ATS in generator position
9. Smoke alarm
10. Wet well level sensor 1 failure
11. West well level sensor 2 failure

H. Telemetry Alarms:

1. The following alarms shall be mapped to digital outputs on the main PLC which are wired to digital inputs on the Telemetry PLC. The telemetry PLC is already set up to send the status of 8 digital input to the Tri-City plant for alarm monitoring and

notification. The alarm points at Tri-City SCADA system shall be reconfigured to match the alarms connected in the field.

a. Wet well high level
b. Wet well high high level
c. Wet well overflow level
d. Control power fail
e. General pump fail
f. ATS in generator position
g. Generator Fault
h. Smoke alarm.

2.3 82ND STATION CONTROL STRATEGY

A. Process Description

1. There are 2 pumps in 82nd pump station that pump collected wastewater to the treatment system. The pumps shall operate on a lead, lag configuration to maintain level in the collection wet well and deliver water to the treatment plant. The operator shall select the pump lead/lag role for each pump. The lead pump shall start and run when the wet well rises above the predetermined lead start level set point. If the level continues to rise above the lag start set point the lag pump shall start after a predetermined time delay. When the well level falls below the lag stop set point for a predetermined time, the lag pump shall stop. The lead pump shall stop if the level falls below the lead stop set point. If the lead pump fails or becomes unavailable, the system shall automatically rotate the pump roles so the lead becomes backup, lag becomes lead and backup becomes lag. The lead/lag pump selection shall rotate at the end of each pump down cycle in order to equalize runtime on each pump.

2. Wet Well Level Selection: The station has redundant level sensors. The higher of two level readings shall be automatically selected for control as long as both sensors are healthy. If one sensor fails (reading out of range), the other sensor shall be selected for control. If both sensors fail, the level process variable shall be set to zero. In this scenario, the station shall operate on backup float control.

B. P&ID: 1B-IC1

C. Equipment

1. Pump 1
2. Pump 2
3. Wet Well Level 1
4. Wet Well Level 2
5. Wet Well High Level Float

6. Wet Well High High Level float
7. Wet Well Overflow Float

D. Local Mode

1. Each pump may be run manually using local controls located on the individual MCC bucket by placing the HAND/OFF/AUTO selector switch in the HAND position. The pump will operate continuously until the operator places the selector switch into the OFF position. Manual operation overrides all software interlocks.

E. Remote Manual Mode

1. Each pump that is placed in Auto mode at the MCC bucket selector switch can be run in Manual from the HMI. When the Hand-Off-Auto switch is in auto and the pump is in manual at the HMI, the operator can start/stop the pump using HMI controls.

F. Remote Auto Mode

1. Remote Auto Prerequisites: The pumps can be operated in remote auto mode by placing the MCC bucket selector switches in the Auto position. In auto mode the pumps will operate in a lead, lag mode. An automatic pumping cycle will begin when the level in the wet well rises above the start lead pump set point. The automatic mode sequence is discussed in section 2.2.A.1 above

2. Float Backup: In any mode, if the wet well level rises and triggers the high level float, pump 1 will start and run at a full speed for a predetermined duration. The duration of the pump run will be set (via timing relay in control panel) to ensure that the pump does not run dry. If the level in the wet well rises high enough to trigger the high high float, pump 2 will be started and run at full speed for a predetermined duration. Each high float in the wet well will be directly linked to one pump to provide independent redundant pump backup operation. Operation of the float backup system is independent of the PLC and will function even when the normal control system is not operating.

3. Operator Inputs: The operator must set the following parameters in the system for automatic mode:

    a. Wet well lead start pump level set point
    b. Wet well lead stop pump level set point
    c. Wet well lag start pump level set point
    d. Wet well lag stop pump level set point
    e. Designate pump roles

G. Alarms:

1. Pump 1 run fail, leak, fault
2. Pump 2 run fail, leak, fault
3. Wet well high level
4. Wet well high high level
5. Wet well over flow level
6. Control power fail
7. Wet well level sensor 1 failure
8. West well level sensor 2 failure

H. Telemetry Alarms:

1. The following alarms shall be mapped to digital outputs on the main PLC which are wired to digital inputs on the Telemetry PLC. The telemetry PLC is already set up to send the status of 8 digital input to the Tri-City plant for alarm monitoring and notification. The alarm points at Tri-City SCADA system shall be reconfigured to match the alarms connected in the field.
   a. Wet well high level
   b. Wet well high high level
   c. Wet well overflow level
   d. Control power fail
   e. Pump 1 fail
   f. Pump 2 fail
   g. Spare
   h. Spare

2.4 SIEBEN LANE STATION CONTROL STRATEGY

A. Process Description

1. There are 2 pumps in Sieben Lane pump station that pump collected wastewater to the treatment system. The pumps shall operate on a lead, lag configuration to maintain level in the collection wet well and deliver water to the treatment plant. The operator shall select the pump lead/lag role for each pump. The lead pump shall start and run when the wet well rises above a predetermined start lead level set point. If the level continues to rise above the lag start set point the lag pump shall start after a predetermined time delay. When the well level falls below the lag stop set point for a predetermined time, the lag pump shall stop. The lead pump shall stop if the level falls below the lead stop set point. If the lead pump fails or becomes unavailable, the system shall automatically rotate the pump roles so the lag becomes lead. When the pumps are operating in automatic mode, the speed of the VFD shall modulate to maintain the wet well set point. If two pumps are running at the same time both pumps shall run at the same speed.

2. Wet Well Level Selection: The station has redundant level sensors. The higher of two level readings shall be automatically selected for control as long as both

sensors are healthy. If one sensor fails (reading out of range), the other sensor shall be selected for control. If both sensors fail, the level process variable shall be set to zero. In this scenario, the station shall operate on backup float control.

B. P&ID: 1B-IC1

C. Equipment

1. Pump 1
2. Pump 2
3. Discharge Flow Meter
4. Wet Well Level 1
5. Wet Well Level 2
6. Wet Well High Level Float
7. Wet Well High High Level float
8. Wet Well Overflow Float

D. Local Mode

1. Each pump may be run manually using local controls located on the individual MCC bucket by placing the HAND/OFF/AUTO selector switch in the HAND position. The pump will operate continuously until the operator places the selector switch into the OFF position. Manual operation overrides all software interlocks.

E. Remote Manual Mode

1. Each pump that is placed in Auto mode at the MCC bucket selector switch can be run in Manual from the HMI. When the Hand-Off-Auto switch is in auto and the pump is in manual at the HMI, the operator can start/stop the pump using HMI controls.

F. Remote Auto Mode

1. Remote Auto Prerequisites: The pumps can be operated in remote auto mode by placing the MCC bucket selector switches in the Auto position. In auto mode the pumps will operate in a lead, lag mode. An automatic pumping cycle will begin when the level in the wet well rises above the start lead pump set point. The automatic mode sequence is discussed in section 2.2.A.1 above

2. Float Backup: In any mode, if the wet well level rises and triggers the high level float, pump 1 will start and run at a full speed for a predetermined duration. The duration of the pump run will be set (via timing relay in control panel) to ensure that the pump does not run dry. If the level in the wet well rises high enough to trigger the high high float, pump 2 will be started and run at full speed for a predetermined duration. Each high float in the wet well will be directly linked to one pump to provide independent redundant pump backup operation. Operation

of the float backup system is independent of the PLC and will function even when the normal control system is not operating.

3. Operator Inputs: The operator must set the following parameters in the system for automatic mode:

    a. Wet well lead start pump level set point
    b. Wet well lead stop pump level set point
    c. Wet well lag start pump level set point
    d. Wet well lag stop pump level set point
    e. Wet well level set point
    f. Designate pump roles

G. Alarms:

1. Pump 1 run fail, leak, fault
2. Pump 2 run fail, leak, fault
3. Wet well high level
4. Wet well high high level
5. Wet well over flow level
6. Vault flood
7. Building intrusion
8. Control power fail
9. Utility power fail/ATS in generator position
10. Smoke alarm
11. Wet well level sensor 1 failure
12. West well level sensor 2 failure

H. Telemetry Alarms:

1. The following alarms shall be mapped to digital outputs on the main PLC which are wired to digital inputs on the Telemetry PLC. The telemetry PLC is already set up to send the status of 8 digital input to the Tri-City plant for alarm monitoring and notification. The alarm points at Tri-City SCADA system shall be reconfigured to match the alarms connected in the field.
    a. Wet well high level
    b. Wet well high high level
    c. Wet well overflow level
    d. Control power fail
    e. General pump fail
    f. ATS in generator position
    g. Generator Fault
    h. Smoke alarm.

I. Other Telemetry Alarms:

1. Additional alarms shall be configured at Tri-City Field Operations HMI.
    a. Communication failure with remote site

END OF SECTION

SECTION 40 95 11 - PLC CONTROL SYSTEM HARDWARE

PART 1 GENERAL

1.1 THE REQUIREMENT

A. GENERAL:

1. The CONTRACTOR, through the use of a qualified electrical installer, shall provide the PLC based control system (PLCS) complete and operable in accordance with the Contract Documents.

B. This specification section applies to PLC control systems for South Welches, Golf Club Terrace, and 82nd Pump Stations pump stations.

C. The CONTRACTOR shall be singularly responsible for selecting, configuring, and verifying correct operation of compatible hardware.

D. Whenever possible the PLC/controller hardware shall be standardized so as to utilize off-the-shelf, commercially available configurations of hardware. The CONTRACTOR shall be responsible for the following, as a minimum:

1. Procurement of all hardware.

2. Design and submit PLC/Control hardware and all spare parts submittals for Engineer approval.

3. Perform all PLCS test adjustments and calibrations.

4. Provide qualified labor to supervise the installation of PLCS system by electrical CONTRACTOR.

5. Perform PLCS startup and commissioning activities.

6. Provide tools, test equipment, spare parts, supplies, operation and maintenance manual, and control system record drawings.

E. PLCS Configuration:

1. The PLCS shall consist of PLCs/controller, Operator Interface Terminals, PC-based operator workstations, servers, communication modules, and all required equipment and peripherals as shown on the contract drawings, and as described in these specifications, and as required to meet the functional intent of the specifications.

1.2 SUBMITTALS

A. Shop Drawings:

1. Shop drawings for PLC control panels showing panel layout, dimensions and wiring details.

2. Bill of materials for control panels.

B. Hardware submittals:

1. Components data sheets with part numbers for the following clearly indicating intended components:

a. PLC CPU and IO modules.
b. PLC accessories, memory cards, power supplies
c. Power supplies
d. Relays
e. Terminal blocks
f. HMI panels.
g. Surge suppressors
h. Uninterruptable power supplies (UPS)
i. Panel light
j. Indicator lights, buttons and selector switches
k. Panel enclosure and back panel
l. Circuit breakers
m. Miscellaneous electrical components

C. Owners O&M Manual:

1. Detailed owners O&M manual shall be provided in accordance with Section 40 91 00. The following items shall be included in the O&M manual:

a. Record drawings for PLCS control system wiring and networks.

b. PLCS component list with part numbers and manufacturer information.

c. PLCS component user manuals.

d. Instrument data sheets with part number, manufacturer, setup/calibration information.

e. Instrument cut sheets and user manuals.

f. Recommended spare parts list

D. System Test Procedures

1. System test procedures shall be developed by the CONTRACTOR in accordance with the requirements for system testing indicated below in section 3.02 below, and shall be submitted to the ENGINEER for review. An approved submittal shall be required prior to the commencement of system testing.

2. The procedures shall be in narrative form, and shall sequentially describe the operational steps to be followed in verifying the correct operation of each control component.

1.3 STORAGE AND HANDLING

A. All equipment and materials delivered to the Site shall be stored in a location which shall not interfere with the operations of the OWNER's personnel or interfere with construction. Storage and handling shall be performed in a manner which shall afford maximum protection to the equipment and materials. It is the CONTRACTOR's responsibility to assure proper handling and on-site storage.

1.4 WARRANTY REQUIREMENTS

A. Equipment, software, and materials which do not achieve design requirements after installation shall be replaced or modified by the CONTRACTOR to attain compliance. The cost for doing so shall be the CONTRACTOR's responsibility. Following replacement or modification, the CONTRACTOR shall retest the system and perform any additional procedures needed to place the complete PLCS in satisfactory operation and attain design compliance approval from the ENGINEER.

B. The CONTRACTOR warrants the materials and workmanship used for the PLCS equipment and materials and further guarantees the materials and workmanship used for any equipment and materials produced and furnished hereunder as a part of the Work to be as required and agreed upon, free from injurious defects, and in all respects satisfactory for the service required.

C. The CONTRACTOR warrants/guarantees the satisfactory performance of the equipment and materials under operating conditions for a period of 1 years after the date of final acceptance of the entire system.

PART 2 PRODUCTS

2.1 GENERAL

A. The requirements of Section 40 91 00 apply to this Section.

B. All material and all PLCS equipment furnished under this Contract shall be new, free from defects, of first quality and produced by manufacturers regularly engaged in the manufacture of these products.

C. Hardware Commonality: Where there is more than one item of similar equipment being furnished all such similar equipment shall be the product of a singular manufacturer

D. The CONTRACTOR shall furnish PLCS hardware that matches the existing facility SCADA system standard as called out in section 2.04.F of this specification. This applies to PLCS hardware such as CPU's, I/O modules, communication modules, power supplies and chassis. This requirement is in place to ensure communication compatibility between existing PLC's and new vendor supplied PLC's.

2.2 PLCS ENCLOSURES

A. Each PLC and its corresponding I/O modules, power supply module(s), communication interface devices, peripheral equipment, and UPS shall be mounted inside suitable enclosures. All I/O wiring from the field to the I/O modules shall be routed within wire ways and terminated on terminal blocks in the enclosure

B. PLCS enclosures shall be provided in accordance with Section 40 92 00 - Control Panels

2.3 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Provide and install line interactive UPS's in all panels that contain PLC/control equipment.

B. Each UPS shall maintain power of all its loads for 10 minutes.

2.4 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. CONSTRUCTION:

1. Each PLC central processing unit (CPU) shall be of solid state design and rated for operation in an industrial environment subject to heat, vibration, RFI, electrical transients and dust. The PLC equipment shall be capable of operating in a temperature of 0 to 60 degrees C at 95 percent humidity, non condensing without air conditioning or fans.

B. COMPONENTS-GENERAL:

1. Each PLC shall have the necessary memory and computing capabilities necessary to carry out the control objectives. It is the responsibility of the CONTRACTOR to select the appropriate PLC equipment for the control application.

C. CPU:

1. The PLC CPU shall contain all relays, timers, counters, memory registers, arithmetic capability, PID loop control and comparators necessary for the control application. The CPU shall be programmable in Ladder Logic, using PLC manufacturer programming software.

D. MEMORY:

1. The PLC CPU shall contain sufficient memory for proper program loading and execution. The PLC CPU shall contain an internal battery or non-volatile memory to ensure proper storage of the control logic application when the CPU is without power.

E. DATA COMMUNICATION:

1. Each PLC shall have the following communication ports built in or provided as an add on module in the PLC chassis:

a. One industrial standard, IEEE 802.3 100BaseT Ethernet communication port (RJ45).

b. One RS-232C serial programming port if required for programming, maintenance or other purposes as recommended by blower equipment supplier.

F. MANUFACTURER**:**

1. The PLC shall be manufactured by Siemens. The PLC CPU shall be Siemens 1500 series as shown on project drawings.

2.5 PLC POWER SUPPLY

A. PLC power supplies shall accept incoming 120 VAC 60 Hz single phase or 24 VDC and convert this to the necessary voltages required to operate the PLC CPU and IO modules.

B. The PLC power supply shall be mounted in the PLC housing or chassis and provide sufficient power for operating all CPU's and IO modules. The PLC/control power supply shall be sized to provide 25% extra capacity.

2.6 PLC INPUT/OUTPUT (I/O) MODULES

A. GENERAL:

1. All PLC I/O modules shall be suitable for use in hostile industrial environments as described in section 2.04.A above. In general, I/O signal types shall be determined

by the CONTRACTOR for the appropriate control application. Analog input and output signals shall be either 4-20mA or 0-10VDC. Digital input signals shall be 120VAC or 24VDC. Discrete output modules shall be 120VAC, 24VDC or relay contact and needed for the control application. Each location shall contain the I/O modules necessary for the control application plus 20% spare. All unused and spare IO points shall be wired to field terminals for easy utilization in the future.

B. DISCRETE INPUT MODULES:

1. Discrete input modules shall be Siemens model compatible with selected PLC CPU, selected by the CONTRACTOR for the control application.

C. DISCRETE OUTPUT MODULES:

1. Discrete output modules shall be model compatible with selected PLC CPU, selected by the CONTRACTOR for the control application.

D. ANALOG INPUT MODULES:

1. Analog Input modules shall be Siemens model compatible with selected PLC CPU, selected by the CONTRACTOR for the control application.

E. ANALOG OUTPUT MODULES:

1. Analog output modules shall be Siemens model compatible with selected PLC CPU, selected by the CONTRACTOR for the control application.

2.7 PERIPHERAL DEVICES

A. GENERAL:

1. Peripheral devices shall be furnished and installed by the CONTRACTOR as detailed in this section.

B. NETWORK SWITCHES:

1. Network switches shall have a minimum of five 10/100 Mbit/s RJ45 ports. Network switches shall be rated for use in an industrial control environment, DIN rail mounted with wired power connections. See specification section 40 92 00 2.05.G.

2. Include minimum of one 1000BaseSX Multimode GB Fiber Optic Port (LC Connector) only as needed or required by project drawings.

2.8 SPARE PARTS

A. Spare parts shall be furnished as specified below:

1. Provide one spare of each unique type of Input/Output module.

PART 3 EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall utilize qualified personnel to supervise and accomplish the physical installation of all components which it provides.

3.2 TESTING

A. FACTORY TESTING:

1. Prior to delivery and installation, the PLC hardware components shall be tested for proper operation as part of the Control Panel factory testing as described in Section 40 92 00 3.1.

END OF SECTION

SECTION 43 21 00 - LIQUID PUMPS

PART 1 GENERAL

1.1 SUMMARY

A. The provisions of this Section shall apply to all pumps and pumping equipment except where otherwise indicated.

B. Where two or more pump systems of the same type or size are required, all pumps shall all be produced by the same manufacturer.

C. Provide all labor, equipment and materials and perform all operations in connection with the installation and testing of pumps selected by the OWNER.

D. Coordinate and utilize all factory testing, installation, start-up and field testing services supplied in conjunction with the pumping equipment.

E. All work performed under this Section shall be in accordance with all approved trade practices and manufacturer's recommendations.

F. Section includes:

1. General design requirements for liquid pumps.
2. Factory testing.

G. Related Requirements:

1. Section 43 21 39 - Submersible Liquid Pumps.

1.2 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Provide the following information:

1. Pump name, identification number and applicable Section number from Project specifications.

2. Performance Data Curves:

a. Showing head, capacity, horsepower demand, NPSH required and pump efficiency over the entire operating range of the pump.

b. Pump manufacturer shall indicate separately the head, capacity, horsepower demand, overall efficiency and minimum submergence required at the design flow conditions and the maximum and minimum flow conditions.

c. A family of performance curves at intervals of 100 rpm from minimum speed to maximum speed shall be provided for each pump equipped with a variable speed drive.

3. The limits on the performance curves recommended for stable operation without surge, cavitation or excessive vibration.

4. Assembly and Installation Drawings: Including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.

C. Complete motor nameplate data as defined by NEMA, motor manufacturer and any motor modifications.

D. Operation and Maintenance Manual: Containing the required information for each pump section.

E. Spare Parts List: Containing the required information for each pump section.

F. Factory Test Data: Signed, dated and certified for each pump system which requires factory testing submitted before shipment of equipment.

G. Certifications:

1. Manufacturer's certification of proper installation.
2. CONTRACTOR's certification of satisfactory field testing.

H. All pump motor information as required in Division 43.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials and equipment shall be standard products of a manufacturer and distributor regularly engaged in the manufacture and distribution of such products for at least 2 (two) years and shall be suitable for the service intended.

B. All materials and equipment shall be new and unused except for the testing specified herein.

C. Compliance with the requirements of the individual pump sections may necessitate modifications to the manufacturer's standard equipment.

D. All components of each pump system provided under the pump sections shall be entirely compatible. Each unit of pumping equipment shall incorporate all basic mechanisms, couplings, electric motors or engine drives, variable speed controls, necessary mountings and appurtenances.

E. The pumps shall be supplied by a distributor authorized to service them throughout the warranty period and beyond. The distributor shall be located within a 100-mile radius of the site.

F. The pumps shall be warranted by the manufacturer as specified in other Sections.

G. The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, suction cans, baseplates, couplings, guards and other accessories.

H. The complete pump assembly shall be designed and built for continuous service at any and all points within the specified range of operation, without overheating, without damaging cavitation, and without excessive vibration or noise.

2.2 MATERIALS

A. All materials shall be suitable for the intended application; materials not specified shall be high-grade, standard commercial quality, free from all defects and imperfection that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements:

1. Cast iron pump casings and bowls shall be of close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Casings, Class 30, or equal.

2. Stainless steel pump shafts shall be Type 416 or 316.

3. Miscellaneous stainless steel shall be of Type 316, except in a septic environment.

4. Anchor bolts, washers, and nuts supplied by the CONTRACTOR for non-corrosive applications shall be galvanized steel in accordance with the requirements of Section 05 50 00, Metal Fabrications. Anchor bolts, washers and nuts in corrosive service applications shall be stainless steel in accordance with that Section.

2.3 PUMP COMPONENTS, GENERAL

A. Flanges: Suction and discharge flanges shall conform to ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 12, 125, 250, and 800 or B16.5 - Flanges and Flanged Fittings dimensions.

B. Handholes: Handholes on pump casings shall be shaped to follow the contours of the casing to avoid any obstructions in the water passage.

2.4 PUMP APPURTENANCES

A. Nameplates: Each pump shall be equipped with a stainless steel nameplate indicating serial numbers, rated head and flow, impeller size, pump speed and manufacturer's name and model number.

2.5 FACTORY TESTING

A. The following tests shall be conducted on each indicated pump system:

1. Pump Systems: All pump systems 50 hp and larger shall be tested at the pump factory in accordance with the American National Standard for Centrifugal Pump Tests (ANSI/HI 1.6) or the American National Standard for Vertical Pump Tests (ANSI/HI 2.6) as approved by ANSI and published by the Hydraulic Institute.

2. Tests shall be performed using the complete pump system to be furnished, including the motor.

3. For motors 100 hp and smaller, the manufacturer's certified test motor shall be acceptable. The following minimum test data shall be submitted:

    a. Hydrostatic test data.

    b. A minimum of five hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, recorded on data sheets as defined by the Hydraulic Institute.

    c. Pump curves showing head, flow, bhp, and efficiency.

    d. Certification that the pump horsepower demand did not exceed the rated motor hp beyond the 1.0 service rating at any point on the curve.

    e. Pump test data curves showing head, flowrate, bhp, and efficiency. Acceptance level shall be Grade 1E as defined by ANSI/HI 14.6.

4. Factory Witnessed Tests: Factory witnessed testing for this project not required.

5. Acceptance: In the event of failure of any pump to meet any of the requirements, the CONTRACTOR and Pump Manufacturer shall make all necessary modifications, repairs or replacements to conform to the requirements of the Contract Documents and the pump shall be retested at no additional cost to the OWNER until found satisfactory.

PART 3 EXECUTION

3.1 SERVICES OF PUMP MANUFACTURER

A. An authorized service representative of the manufacturer shall visit the Site to witness the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted and readied for operation:

1. Installation of the equipment.

2. Inspection, checking and adjusting the equipment.

3. Startup and field testing for proper operation.

4. Performing field adjustments to ensure that the equipment installation and operation comply with requirements.

5. Requirements are more specifically detailed herein and in individual pump specifications.

B. Instruction of the OWNER's Personnel:

1. An authorized training representative of the manufacturer shall visit the Site to instruct the OWNER's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment.

2. Instruction shall be specific to the models of equipment provided.

3. The pump manufacturer's representative shall have at least two years' experience in training.

4. Training shall be scheduled a minimum of three weeks in advance of the first session.

5. Proposed training material and a detailed outline of each lesson shall be submitted for review. Comments shall be incorporated into the material.

6. The training materials shall remain with the trainees.

7. The OWNER may videotape the training for later use with the OWNER's personnel.

3.2 INSTALLATION

A. General: Pumping equipment shall be installed in accordance with the manufacturer's written recommendations.

B. Alignment:

1. All equipment shall be field tested to verify proper alignment, operation as specified and freedom from binding, scraping, vibration, shaft runout or other defects.

2. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing.

3. Equipment shall be secure in position and neat in appearance.

C. Lubricants: Provide the necessary oil and grease for initial operation.

3.3 FIELD TESTS

A. Each pump system shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, cavitation or overheating of bearings.

B. Field testing methods and allowable tolerances shall comply with Hydraulic Institute Standard Section 9.6.8 Rotodynamic Pump Guidelines of pumping machinery for the type of pumps installed.

C. The following field testing shall be conducted at the South Welches, Golf Club Terrace, 82nd Drive and Sieben Lane Pump Stations:

1. Startup, check and operate the pump system over its entire speed range.

2. Obtain concurrent readings of motor voltage, amperage, pump discharge head for at least four pumping conditions at each pump rotational speed. Check each power lead to the motor for proper current balance.

3. Electrical and instrumentation tests shall conform to the requirements of the Section under which that equipment is specified.

D. Pump vibration analysis and measurement field testing shall be conducted at the South Welches Pump Station:

1. Pump vibration analysis and measurement in accordance with the Hydraulic Institute Standards Section 11.6. at a minimum of four pumping conditions defined by the ENGINEER. The maximum allowable amplitude of vibration will be 0.34 in/sec.

2. Provide written proof of vibration readings and provide test data.

3. CONTRACTOR shall provide a professional vibration analysis specialist to perform on-site vibration testing. The work shall be directed by a registered professional mechanical engineer who has been providing vibration monitoring services for a minimum of 10 years.

E. Field testing will be witnessed by the ENGINEER. The CONTRACTOR shall furnish three days advance notice of field testing.

F. In the event any pumping system fails to meet the test requirements, it shall be modified and retested as above until it satisfies the requirements.

G. After each pumping system has satisfied the requirements, the CONTRACTOR shall certify in writing that it has been satisfactorily tested and that all final adjustments have been made. Certification shall include the date of the field tests, a listing of all persons present during the tests and the test data.

H. CONTRACTOR shall bear all costs of field tests, including additional services of the manufacturer's representative required beyond those specified.

END OF SECTION

SECTION 43 21 39 - SUBMERSIBLE LIQUID PUMPS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes furnishing, start-up, testing, and operation training for submersible sewage pumps.

1. Schedule D Sieben Lane Pump Station: The OWNER will furnish the pumps and cables. The CONTRACTOR is to supply components compatible with the pumps specified herein, including, but not limited to MiniCAS II units, dual guide rail systems, lifting devices and discharge elbows.

B. Section includes:

1. Submersible sewage sump pumps.

C. Related Sections

1. Section 01 75 16, Testing, Training & System Start-Up.
2. Section 10 14 10, Identifying Devices.
3. Section 40 05 13, Common Work Results for Process Piping.
4. Section 43 21 00, Liquid Pumps.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

A. Per the requirements of Section 43 21 00, Liquid Pumps.
B. Applicable material certifications and testing certificates.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

B. Pump Supplier: Manufacturer’s installation and operation certificate. Statement that the equipment is suitable for the intended use.

1.5 FACTORY TESTING

A. Pump manufacturer shall provide the following factory tests in accordance with Section 43 21 00, Liquid Pumps:

1. Performance test.
2. Hydrostatic test.
3. Submersible motor integrity test.
4. Vibration test.

1.6 COORDINATION

A. Like items of equipment specified herein shall be the end product of one manufacturer.

B. Electrical controls and motor design requirements are specified in this Section and Division 26, Electrical.

C. Coordinate pump requirements with the pump drive manufacturer. Contractor shall be responsible for the overall pump and drive performance.

1.7 WARRANTY

A. Submersible sewage pumps shall be warranted by the manufacturer for a minimum of five (5) years and shall meet or exceed the following warranty requirements:

1. Full warranty for the first 2 years.
2. Limited 50% warranty for any claim during years 3 and 4.
3. Limited 25% warranty for any claim during the 5th year.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Schedule A: South Welches Pump Station

1. Manufacturers:

a. Xylem, Flygt, Model NT 3153 HT with MiniCAS II monitoring and status unit.
b. Approved equal.

2. Identification:

Location	South Welches Pump Station
Pump Label(s)	P-1, P-2
Quantity	2

3. Power and Motor Requirements:

Voltage	480 V
Phase	3
Frequency	60 Hz
Motor Speed	1,760 rpm

Motor Horsepower	20 hp

4. Performance Requirements at Full Pump Speed, Two Pumps Running

Duty Point 1 Minimum Flow Capacity	628 gpm
Duty Point 1 Total Dynamic Head	78.3 feet
Duty Point 1 Minimum Pump Efficiency	73.6%
Maximum NPSH required at Duty Point 1	14.9 feet

5. Operating Conditions:

Duty	Continuous
Drive	Variable Frequency Drive
Ambient Environment	Wet Well - Corrosive
Ambient Temperature	33° - 104° F
Fluid Service	Municipal wastewater, raw and unscreened, containing rags, grit, fats, oil, and debris.
Minimum Solids Passing Capability	Flygt N-Impeller
Fluid Temperature	50° - 90° F
Fluid pH Range	6.0 to 8.0
Fluid Specific Gravity	1.0
Net Positive Suction Head Available at Duty Point 1	32.8 feet

6. Pumping System Dimensions:

Minimum Pump Discharge Size	6-inch
Base Elbow Discharge Size	6-inch
Discharge Flange Rating (ANSI)	Class 125
Minimum Submersible Cable Length	As Required

B. Schedule B: Golf Club Terrace Pump Station

1. Manufacturers:

   a. Xylem, Flygt, Model NT 3127 HT with MiniCAS II monitoring and status unit.
   b. Approved equal.

2. Identification:

Location	Golf Club Terrace Pump Station
Pump Label(s)	P-1, P-2
Quantity	2

3. Power and Motor Requirements:

Voltage	230 V
Phase	3
Frequency	60 Hz
Motor Speed	1,750 rpm
Motor Horsepower	7.5 hp

4. Performance Requirements at Full Pump Speed, Two Pumps Running

Duty Point 1 Minimum Flow Capacity	145 gpm
Duty Point 1 Total Dynamic Head	56.3 feet
Duty Point 1 Minimum Pump Efficiency	44.1%
Maximum NPSH required at Duty Point 1	14.8 feet

5. Operating Conditions:

Duty	Continuous
Drive	Variable Frequency Drive
Ambient Environment	Wet Well - Corrosive
Ambient Temperature	33° - 104° F
Fluid Service	Municipal wastewater, raw and unscreened, containing rags, grit, fats, oil, and debris.
Minimum Solids Passing Capability	Flygt N-Impeller
Fluid Temperature	50° - 90° F
Fluid pH Range	6.0 to 8.0
Fluid Specific Gravity	1.0
Net Positive Suction Head Available at Duty Point 1	25 feet

6. Pumping System Dimensions:

Minimum Pump Discharge Size	4-inch
Base Elbow Discharge Size	4-inch
Discharge Flange Rating (ANSI)	Class 125
Minimum Submersible Cable Length	As Required

C. Schedule C: 82nd Drive Pump Station

1. Manufacturers:

   a. Xylem, Flygt, Model NT 3127 MT with MiniCAS II monitoring and status unit.
   b. Approved equal.

2. Identification:

Location	South Welches Pump Station
Pump Label(s)	P-1, P-2
Quantity	2

3. Power and Motor Requirements:

Voltage	230 V
Phase	3
Frequency	60 Hz
Motor Speed	1,800 rpm
Motor Horsepower	8.5 hp

4. Performance Requirements at Full Pump Speed, Two Pumps Running

Duty Point 1 Minimum Flow Capacity	216 gpm
Duty Point 1 Total Dynamic Head	54.1 feet
Duty Point 1 Minimum Pump Efficiency	54.8%

Maximum NPSH required at Duty Point 1	14.8 feet

5. Operating Conditions:

Duty	Continuous
Drive	Variable Frequency Drive
Ambient Environment	Wet Well - Corrosive
Ambient Temperature	33° - 104° F
Fluid Service	Municipal wastewater, raw and unscreened, containing rags, grit, fats, oil, and debris.
Minimum Solids Passing Capability	Flygt N-Impeller
Fluid Temperature	50° - 90° F
Fluid pH Range	6.0 to 8.0
Fluid Specific Gravity	1.0
Net Positive Suction Head Available at Duty Point 1	27 feet

6. Pumping System Dimensions:

Minimum Pump Discharge Size	4-inch
Base Elbow Discharge Size	4-inch
Discharge Flange Rating (ANSI)	Class 125
Minimum Submersible Cable Length	As Required

D. Schedule D: Sieben Lane Pump Station (Procured by OWNER)

1. Manufacturers:

   a. Xylem, Flygt, Model NT 3202 HT with MiniCAS II monitoring and status unit.
   b. Approved equal.

2. Identification:

Location	Sieben Lane Pump Station
Pump Label(s)	P-1, P-2
Quantity	2

3. Power and Motor Requirements:

Voltage	480
Phase	3
Frequency	60 Hz
Motor Speed	1,785 rpm
Motor Horsepower	44 hp

4. Performance Requirements at Full Pump Speed, Two Pumps Running

Duty Point 1 Minimum Flow Capacity	1,050 gpm
Duty Point 1 Total Dynamic Head	83 feet
Duty Point 1 Minimum Pump Efficiency	74%
Maximum NPSH required at Duty Point 1	18 feet

5. Operating Conditions:

Duty	Continuous
Drive	Variable Frequency Drive
Ambient Environment	Wet Well - Corrosive
Ambient Temperature	33° - 104° F
Fluid Service	Municipal wastewater, raw and unscreened, containing rags, grit, fats, oil, and debris.
Minimum Solids Passing Capability	Flygt N-Impeller
Fluid Temperature	50° - 90° F
Fluid pH Range	6.0 to 8.0
Fluid Specific Gravity	1.0
Net Positive Suction Head Available at Duty Point 1	30 feet

6. Pumping System Dimensions:

Minimum Pump Discharge Size	6-inch
Base Elbow Discharge Size	N/A
Discharge Flange Rating (ANSI)	Class 125
Minimum Submersible Cable Length	50-ft

2.2 PUMP CONSTRUCTION

A. Pump, General:

1. Heavy-duty, vertical, submersible pump with integral drive motor, single suction, centrifugal, sewage type, suitable for a permanent-type wet well installation.

2. Major pump components shall be of gray cast iron, ASTM A48, Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities.

3. All exposed nuts or bolts shall be AISI type 304 stainless steel.

4. All metal surfaces in contact with the pumped media, other than stainless steel, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

B. Impeller:

1. ASTM A-532 (Alloy III A), 25% chrome cast iron, dynamically balanced, semi-open, multi-vane, back-swept, non-clog design.

2. Vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across spiral grooves located on the volute suction, which shall keep them clear of debris, maintaining an unobstructed impeller leading edge and sustaining a high level of hydraulic efficiency.

3. Screw-shaped leading edges of the hard-iron impeller shall be hardened to 60 HRC and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in raw wastewater.

4. Screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater.

5. Impeller shall be locked to the shaft, held by an impeller bolt and treated with a corrosion inhibitor.

C. Volute:

1. Single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller.

2. Minimum inlet and discharge size shall be as specified.

3. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s).

4. The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed.

5. The insert ring shall be cast of ASTM A-532 (Alloy III A), 25% chrome cast iron and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

D. Shaft:

1. Pump and motor shaft shall be a solid continuous shaft.

2. The pump shaft shall be an extension of the motor shaft.

3. Couplings will not be acceptable.

4. The pump shaft shall be stainless steel ASTM A479 S43100-T.

5. The shaft shall be adequately designed to endure alternating bending stresses and to provide for minimum overhang to reduce shaft deflection and prolong bearing life.

E. Bearings:

1. The pump shaft shall rotate on at least three grease-lubricated bearings.

2. The upper bearing, provided for radial forces, shall be a single roller bearing.

3. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust.

4. The minimum L10 bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed.

5. The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature.

F. Mechanical Seal:

1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies.

2. The lower seal shall be independent of the impeller hub. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate.

3. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring.

4. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system.

5. The seals shall not require maintenance or adjustment and shall be capable of operating in either clockwise or counter-clockwise direction of rotation without damage or loss of seal. Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm.

6. Any intrusion of fluid shall not come into contact with the lower bearings.

7. Conventional double mechanical seals with a single or a double spring between rotating faces, or that require constant differential pressure to affect sealing and are subject to opening and penetration by pumping forces, will not be acceptable.

8. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti leak seal, shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication.

9. The motor shall be able to operate continuously while not submerged without damage while pumping under load. Seal lubricant shall be FDA approved.

G. Cooling System:

1. Each pump/motor unit shall be provided with an integral, self-supplying cooling system. The motor water jacket shall encircle the stator housing and shall be of cast iron, ASTM A 48, Class 35B. The water jacket shall provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air.

2. After passing through a classifying labyrinth, the impeller back vanes shall provide the necessary circulation of the cooling liquid, a portion of the filtered pump media, through the cooling system. Two cooling liquid supply pipes, one discharging low and one discharging high within the jacket, shall supply the cooling liquid to the jacket.

3. An air evacuation tube shall be provided to facilitate air removal from within the jacket. Any piping internal to the cooling system shall be shielded from the cooling media flow allowing for unobstructed circular flow within the jacket about the stator housing. Two cooling liquid return ports shall be provided.

4. The internals to the cooling system shall be non-clogging by virtue of their dimensions. Drilled and threaded provisions for external cooling and seal flushing or air relief are to be provided.

5. The cooling jacket shall be equipped with two flanged, gasketed and bolted inspection ports of not less than 4-inch diameter located 180 degrees apart.

6. The cooling system shall provide for continuous submerged or completely non-submerged pump operation in liquid or in air having a temperature of up to 40°C (104°F), in accordance with NEMA standards. Restrictions limiting the ambient or liquid temperatures at levels less than 40°C are not acceptable.

H. Schedule A: South Welches Pump Station specific installation requirements:

1. Pump Discharge Elbow:

   a. The pump discharge connection shall be the elbow type.

   b. The discharge connection shall be bolted to the structure as recommended by the manufacturer and shall serve as a lower attachment for the guide rails, and as anchorage for the pump.

   c. The anchorage system shall be designed to transmit all forces safely to the structure, and may incorporate intermediate supports as required.

   d. The design shall be non-sparking and shall conform to UL requirements for installation in a Class 1, Division 1, Group D hazardous location.

   e. When in place, the discharge connection shall cause a watertight seal between the pump and the discharge elbow, accomplished by a machined metal to metal contact only, using simple linear downward motion of the pump with the entire weight of the pumping unit guided to and pressing tightly against the discharge connections.

   f. Sealing of the discharge interface with a diaphragm, O-ring, or profile gasket shall not be acceptable. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing.

2. Dual Rail Guide System

   a. The pump shall be provided with a dual rail guide system to automatically and firmly connect the pump to the discharge piping when lowered into place on the discharge elbow.

   b. Once the pump has been positioned on its support fitting at the discharge elbow, the guide rail system shall not be required for pump support. Intermediate support brackets shall be provided as required by manufacturer.

c. The guide rail system shall allow easy removal of the pump without entering the wet well or disturbing the discharge piping. Single rail systems are not acceptable.

d. All components of the guide system and pump anchorage shall be of stainless steel.

3. Lifting Devices:

a. Each pump shall be provided with Flygt Pump Lift Lifting System.

b. Provide minimum of 25 feet of stainless steel cable connected to a short length (approximately ten links long) of high tensile strength proof-tested stainless steel chain of required capacity, connected to the lifting eye or lifting bail of the submersible pump.

c. Provide a forged "grip-eye" of stainless steel, provided separately to connect to the end of the lifting cable or chain of the pump lifting device.

d. All lifting devices shall be rated as lifting devices and shall be provided with certification indicating they are rated for lifting device service.

I. Schedule B: Golf Club Terrace Pump Station specific installation requirements:

1. Pump Discharge Elbow:

a. The pump discharge connection shall be the elbow type.

b. The discharge connection shall be bolted to the structure as recommended by the manufacturer and shall serve as a lower attachment for the guide rails, and as anchorage for the pump.

c. The anchorage system shall be designed to transmit all forces safely to the structure, and may incorporate intermediate supports as required.

d. The design shall be non-sparking and shall conform to UL requirements for installation in a Class 1, Division 1, Group D hazardous location.

e. When in place, the discharge connection shall cause a watertight seal between the pump and the discharge elbow, accomplished by a machined metal to metal contact only, using simple linear downward motion of the pump with the entire weight of the pumping unit guided to and pressing tightly against the discharge connections.

f. Sealing of the discharge interface with a diaphragm, O-ring, or profile gasket shall not be acceptable. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing.

2. Dual Rail Guide System

a. The pump shall be provided with a dual rail guide system to automatically and firmly connect the pump to the discharge piping when lowered into place on the discharge elbow.

b. Once the pump has been positioned on its support fitting at the discharge elbow, the guide rail system shall not be required for pump support. Intermediate support brackets shall be provided as required by manufacturer.

c. The guide rail system shall allow easy removal of the pump without entering the wet well or disturbing the discharge piping. Single rail systems are not acceptable.

d. All components of the guide system and pump anchorage shall be of stainless steel.

3. Lifting Devices:

a. Each pump shall be provided with Flygt Pump Lift Lifting System.

b. Provide minimum of 25 feet of stainless steel cable connected to a short length (approximately ten links long) of high tensile strength proof-tested stainless steel chain of required capacity, connected to the lifting eye or lifting bail of the submersible pump.

c. Provide a forged "grip-eye" of stainless steel, provided separately to connect to the end of the lifting cable or chain of the pump lifting device.

d. All lifting devices shall be rated as lifting devices and shall be provided with certification indicating they are rated for lifting device service.

J. Schedule C: 82nd Drive Pump Station specific installation requirements:

1. Pump Discharge Elbow:

a. The pump discharge connection shall be the elbow type.

b. The discharge connection shall be bolted to the structure as recommended by the manufacturer and shall serve as a lower attachment for the guide rails, and as anchorage for the pump.

c. The anchorage system shall be designed to transmit all forces safely to the structure, and may incorporate intermediate supports as required.

d. The design shall be non-sparking and shall conform to UL requirements for installation in a Class 1, Division 1, Group D hazardous location.

e. When in place, the discharge connection shall cause a watertight seal between the pump and the discharge elbow, accomplished by a machined metal to metal contact only, using simple linear downward motion of the pump with the entire weight of the pumping unit guided to and pressing tightly against the discharge connections.

f. Sealing of the discharge interface with a diaphragm, O-ring, or profile gasket shall not be acceptable. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing.

2. Dual Rail Guide System

    a. The pump shall be provided with a dual rail guide system to automatically and firmly connect the pump to the discharge piping when lowered into place on the discharge elbow.

    b. Once the pump has been positioned on its support fitting at the discharge elbow, the guide rail system shall not be required for pump support. Intermediate support brackets shall be provided as required by manufacturer.

    c. The guide rail system shall allow easy removal of the pump without entering the wet well or disturbing the discharge piping. Single rail systems are not acceptable.

    d. All components of the guide system and pump anchorage shall be of stainless steel.

3. Lifting Devices:

    a. Each pump shall be provided with Flygt Pump Lift Lifting System.

    b. Provide minimum of 25 feet of stainless steel cable connected to a short length (approximately ten links long) of high tensile strength proof-tested stainless steel chain of required capacity, connected to the lifting eye or lifting bail of the submersible pump.

    c. Provide a forged “grip-eye” of stainless steel, provided separately to connect to the end of the lifting cable or chain of the pump lifting device.

    d. All lifting devices shall be rated as lifting devices and shall be provided with certification indicating they are rated for lifting device service.

K. Schedule D: Sieben Lane Pump Station specific installation requirements:

1. Pump Discharge Elbow:

    a. The pump discharge connection shall be the elbow type.

    b. The discharge connection shall be bolted to the structure as recommended by the manufacturer and shall serve as a lower attachment for the guide rails, and as anchorage for the pump.

    c. The anchorage system shall be designed to transmit all forces safely to the structure, and may incorporate intermediate supports as required.

    d. The design shall be non-sparking and shall conform to UL requirements for installation in a Class 1, Division 1, Group D hazardous location.

    e. When in place, the discharge connection shall cause a watertight seal between the pump and the discharge elbow, accomplished by a machined metal to metal contact only, using simple linear downward motion of the pump with the entire weight of the pumping unit guided to and pressing tightly against the discharge connections.

f. Sealing of the discharge interface with a diaphragm, O-ring, or profile gasket shall not be acceptable. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing.

2. Dual Rail Guide System

a. The submersible pumps installed in a wet well shall be provided with a dual rail guide system to automatically and firmly connect the pump to the discharge piping when lowered into place on the discharge elbow.

b. Once the pump has been positioned on its support fitting at the discharge elbow, the guide rail system shall not be required for pump support. Intermediate support brackets shall be provided as required by manufacturer.

c. The guide rail system shall allow easy removal of the pump without entering the wet well or disturbing the discharge piping. Single rail systems are not acceptable.

d. All components of the guide system and pump anchorage shall be of stainless steel.

3. Lifting Devices:

a. Each pump shall be provided with Flygt Pump Lift Lifting System.

b. Provide minimum of 25 feet of stainless steel cable connected to a short length (approximately ten links long) of high tensile strength proof-tested stainless steel chain of required capacity, connected to the lifting eye or lifting bail of the submersible pump.

c. Provide a forged “grip-eye” of stainless steel, provided separately to connect to the end of the lifting cable or chain of the pump lifting device.

d. All lifting devices shall be rated as lifting devices and shall be provided with certification indicating they are rated for lifting device service.

2.3 MOTORS

A. General:

1. Each pump shall be provided with a vertically mounted electric motor that conforms to the following requirements:

a. Motors shall be designed to accept the total, unbalanced thrusts imposed by the pump.

b. The motor and the pump shall be produced by the same manufacturer.

c. The motor shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

B. Motor Design:

1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber.

2. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%.

3. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31.

4. The stator shall be heat-shrink fitted into the cast iron stator housing.

5. The use of multiple step dip and bake-type stator insulation process is not acceptable.

6. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.

7. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40°C (104°F) with an 80°C temperature rise and capable of at least 15 evenly spaced starts per hour.

8. The rotor bars and short circuit rings shall be made of cast aluminum.

C. Service Factors:

1. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15.

2. The motor shall have a voltage tolerance of plus or minus 10%.

3. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C.

4. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no load characteristics.

D. Moisture Protection:

1. A mechanical float switch (FLS) shall be mounted in the junction chamber to signal if there is water intrusion.

E. Memory Module:

1. A pump memory module shall be provided and mounted in the junction chamber to record pump run time, number of starts as well as contain the motor unit performance and manufacturing data and service history.

2. The use of wire nuts or crimp-type connectors is not acceptable.

F. High Temperature Protection:

1. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding.

2. One PT-100 type temperature sensor shall be installed in the stator winding.

3. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel.

4. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals.

G. Power Cable:

1. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices.

2. The power cable shall be of a shielded design in which an overall tinned copper shield is included and each individual phase conductor is shielded with an aluminum coated foil wrap.

3. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber.

4. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

H. Pilot Cable:

1. The pilot cable for connection to the pump protection sensors shall be shielded, twisted pair cable integral with the power cable.

I. Cable Entry Seal:

1. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal.

2. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function.

3. The assembly shall provide ease of changing the cable when necessary using the same entry seal.

4. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top.

5. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

2.4 PROTECTION

A. All stators shall incorporate three bi-metal thermal switches, one for each stator phase winding, connected in series to monitor temperature of the motor winding. Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm. The

stator shall also include one PT-100 type temperature probe to provide for monitoring of the stator temperature.

B. A lower bearing temperature sensor shall be provided. The sensor shall directly contact the outer race of the thrust bearing providing for accurate temperature monitoring.

C. Two leakage sensors shall be provided to detect water intrusion into the stator chamber and junction chamber. A Float Leakage Sensor (FLS), a small float switch, shall be used to detect the presence of water in either the stator chamber or junction chamber. When activated, the FLS will activate an alarm.

2.5 OTHER REQUIREMENTS

A. The head-capacity curve shall exhibit a uniformly rising characteristic from free discharge to shutoff. The pump motor shall be non-overloading at a minimum flow rate equal to 130-percent of Duty Point 1 without employing the service factor.

B. The entire pump assembly shall be U.L. approved as Explosion Proof for operation in a Class 1, Division 1, Group D hazardous location.

PART 3 EXECUTION

3.1 INSPECTION

Inspect pumps and fittings before installation to verify quality of material.

3.2 INSTALLATION

A. Installation:

1. Install and align pumps and fittings in accordance with the manufacturer's printed specifications and at the locations shown on the Drawings.

2. Use anchor bolts furnished or recommended by the manufacturer.

3. Place the pumps using equipment templates.

B. Anchorage:

1. Anchors for the unit shall be set in the concrete. Unit shall be mounted as instructed by the manufacturer.

2. Anchors shall be drilled and set with epoxy.

3. Provide 24 hours' notice prior to installing base elbows, to allow for anchor bolt inspection.

4. The manufacturer shall supervise installation to ensure that the unit is properly aligned and leveled; that all electrical and piping connections are properly made; and that lubricants have been provided and installed.

3.3 STARTUP AND TESTING

A. See Section 01 75 16, Testing, Training & System Start-Up for additional requirements.

B. See Section 3.3, 43 21 00 Liquid Pumps for field testing requirements in addition to those specified herein.

C. Pre-operational Checks:

1. Check pump and motor alignment.
2. Check for proper motor rotation.
3. Check pump and drive units for proper lubrication.

D. Manufacturer's Representative:

1. Furnish a representative of the manufacturer to perform inspection, start-up and training services.

2. The manufacturer's representative shall be experienced in the operation and maintenance of the equipment and shall instruct the Owner's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment.

3. Check pump and motor for high bearing temperature and excessive vibration.

4. The representative shall check the installation and supervise initial start-up of the equipment, and shall perform, at a minimum, the following tests on each pump:

   a. Measure and record shutoff head and power draw at shutoff head.

   b. Measure and record actual operating head and power draw at actual operating head.

   c. Measure and record operating head and power draw at two separate partially throttled flow rates.

   d. Measure and record static head.

   e. Duplicate all normal operating modes and all failure modes, including the removal and installation of pumps from the wet well using the guide rail system.

5. Testing shall include a comparison of measured installed flow and head, including shutoff head, with the manufacturer's curve value. Any discrepancy shall be resolved prior to acceptance by the Owner.

6. Manufacturer's Written Certification:

   a. The manufacturer's representative shall verify the complete assembly for proper alignment and connection, and quiet operation.

   b. This service shall be provided for a minimum period of one trip and one day.

c. After the installation and operation of the equipment has been certified, the manufacturer's representative shall train the Owner's personnel in the proper operation and maintenance of the equipment.

E. Verify pumps are operating at the design duty condition. Remove and replace units that do not meet the design operating criteria.

F. For all pump tests, ensure that the force main is full of liquid during the testing. The Contractor shall provide the necessary water and other materials required for the testing as defined herein and recommended by the manufacturer. All testing shall use clean water as required by Section 01 75 16, Testing, Training & System Start-Up.

G. Submersible Pump Lift Test:

1. Lift each submersible pump above the access hatch and then lower the pump back down onto the discharge elbow to demonstrate adequate clearances, smooth operation of the guide rail system, and proper re-seating of the pump on the discharge elbow.

H. A start-up report, acceptable to and approved by the Engineer, shall be completed by the manufacturer's representative before final acceptance of the pumps.

END OF SECTION

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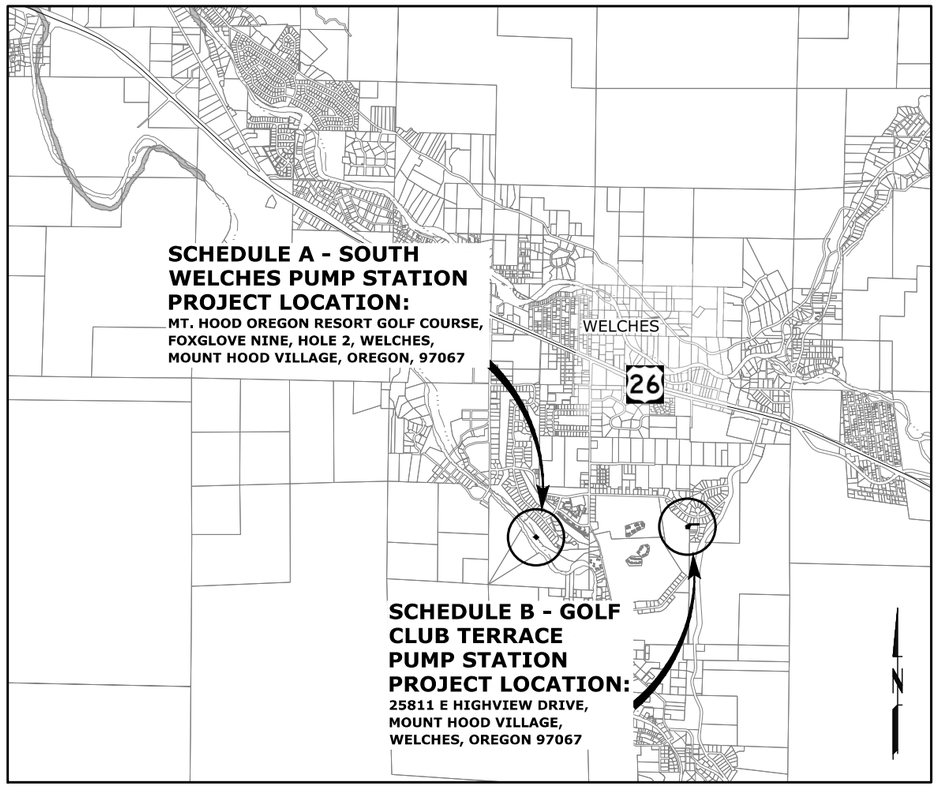
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CLACKAMAS WATER ENVIRONMENT SERVICES

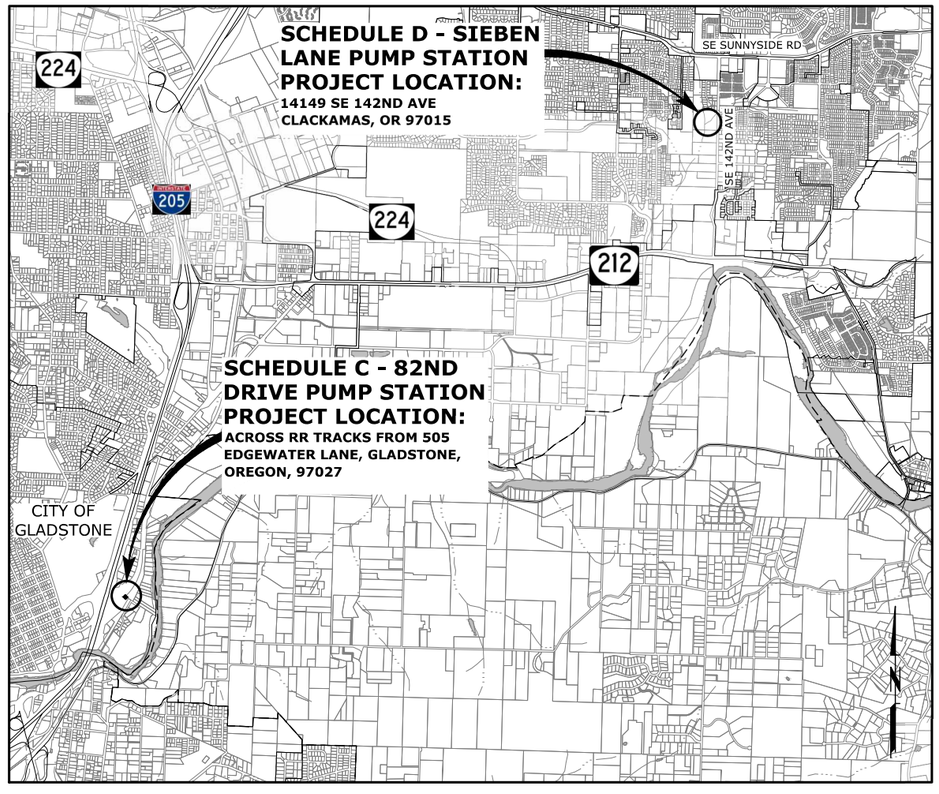
PUMP STATION REHABILITATION AND UPGRADES PROJECT

GROUP 3 - SOUTH WELCHES, GOLF CLUB TERRACE, 82ND DRIVE AND SIEBEN LANE PUMP STATIONS

MAY 2025



VICINITY MAP
SCALE: 1"=2,000'



VICINITY MAP
SCALE: 1"=2,000'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: JCC
CHECKED: EPK
APPROVED: NSL

SHEET 3-G1 1 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98122 — Nicholas Scott Laferriz — Date: — RENEWS 12-31-26

REGISTERED LANDSCAPE ARCHITECT — OREGON — 2008008 — Nicholas Scott Laferriz — Date: — RENEWS 12-31-26

SCALE: VERT.: AS SHOWN HORIZ.: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

TITLE SHEET, LOCATION & VICINITY MAPS

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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Know what's **below.**
Call before you dig.

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: MBE
CHECKED: EPK
APPROVED: NSL

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REGISTERED PROFESSIONAL ENGINEER — OREGON — 98122PE — Nicholas Scott Laferriere — Date: — RENEWS 12-31-26

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98122PE — Nicholas Scott Laferriere — Date: — RENEWS 12-31-26

SCALE
VERT: AS SHOWN
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

INDEX OF DRAWINGS

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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GENERAL NOTES

1. ALL WORK AND MATERIALS SHALL CONFORM WITH THE CONSTRUCTION STANDARDS AND SPECIFICATIONS OF CLACKAMAS WATER ENVIRONMENTAL SERVICES (WES). ALL REFERENCED CLACKAMAS WES STANDARD DETAILS ARE CONSIDERED TO BE PART OF THE CONTRACT DOCUMENTS.

2. OWNER WILL APPLY AND PAY FOR BUILDING AND TRADE PERMITS REQUIRED FOR THIS PROJECT. THE CONTRACTOR SHALL FINALIZE THE PERMITS DURING CONSTRUCTION, COORDINATE INSPECTION, AND GAIN APPROVAL.

3. ATTENTION: OREGON LAW REQUIRES THE CONTRACTOR TO FOLLOW THE RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. THE CONTRACTOR MAY OBTAIN COPIES OF THE RULES BY CALLING THE UTILITY NOTIFICATION CENTER. (NOTE: THE TELEPHONE NUMBER FOR THE OREGON UTILITY NOTIFICATION CENTER IS 503-246-6699.)

4. CONTRACTOR SHALL MAINTAIN, RELOCATE OR REPLACE EXISTING PROPERTY CORNERS, SURVEY MONUMENTS AND CONTROL POINTS AT NO ADDITIONAL COST TO OWNER USING A PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF OREGON.

5. CONTRACTOR SHALL KEEP AND MAINTAIN A CURRENT SET OF DRAWINGS ON SITE. CONTRACTOR TO KEEP ACCURATE "AS-BUILT" RECORD COPY OF PLANS. UPON COMPLETION OF CONSTRUCTION, CONTRACTOR SHALL SUBMIT A CLEAN SET OF FIELD RECORD DRAWINGS TO ENGINEER CONTAINING ALL AS-BUILT INFORMATION FOR USE IN THE PREPARATION OF AS-BUILT DRAWINGS FOR SUBMITTAL TO OWNER.

6. CONTRACTOR SHALL MAINTAIN ACCESS TO ALL HOMES AND BUSINESSES AT ALL TIMES. PROVIDE WRITTEN NOTICE TO ALL PROPERTY OWNERS AT LEAST TWO (2) BUSINESS DAYS IN ADVANCE OF STARTING WORK.

7. CONTRACTOR SHALL NOTIFY THE OWNER 48 HOURS BEFORE STARTING CONSTRUCTION, AND 24 HOURS BEFORE RESUMING WORK AFTER SHUTDOWNS EXCEPT FOR NORMAL RESUMPTION OF WORK FOLLOWING SATURDAYS, SUNDAYS, OR HOLIDAYS. CONTRACTOR SHALL NOTIFY THE OWNER A MINIMUM OF 48 HOURS PRIOR TO ANY TESTING OR REQUIRED INSPECTION.

8. ANY ALTERATION OR VARIANCE FROM THESE PLANS, EXCEPT MINOR FIELD ADJUSTMENT NEEDED TO MEET EXISTING FIELD CONDITIONS, SHALL FIRST BE APPROVED BY THE ENGINEER. ANY ALTERATIONS OR VARIANCE FROM THESE PLANS SHALL BE DOCUMENTED ON CONSTRUCTION FIELD PRINTS AND TRANSMITTED TO THE ENGINEER. ANY PROPOSED CHANGE IN CONSTRUCTION PLANS MUST BE SUBMITTED IN WRITING AND APPROVED BY ENGINEER PRIOR TO COMMENCING WORK.

9. THE CONTRACTOR SHALL DISPOSE OF ALL REMOVED OR REPLACED MATERIAL AND EQUIPMENT IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS, EXCEPT THOSE ITEMS DESIGNATED BY THE OWNER FOR SALVAGING. SALVAGED ITEMS SHALL REMAIN THE PROPERTY OF THE OWNER, AND SHALL BE CAREFULLY REMOVED AND STORED AS DIRECTED.

10. CONTRACTOR SHALL RESTORE ALL STRUCTURES, LOTS, SWALES, DITCHES, CURBS, FENCES, WALLS, MAILBOXES, SIGNS, POLES, GUY WIRES, PIPING, AND UTILITIES DISTURBED DURING CONSTRUCTION TO EXISTING CONDITIONS UNLESS OTHERWISE SPECIFIED.

11. CONTRACTOR SHALL SUBMIT A TRAFFIC CONTROL PLAN TO THE APPLICABLE JURISDICTION FOR APPROVAL. A COPY OF THE APPROVED TRAFFIC CONTROL PLAN SHALL BE PROVIDED TO THE ENGINEER AND AVAILABLE AT THE WORK SITE. THE APPLICABLE JURISDICTION RESERVES THE RIGHT TO ADD TO OR MODIFY TRAFFIC CONTROL REQUIREMENTS AS MAY BE NECESSARY TO EFFECTIVELY CONTROL TRAFFIC AND TO ASSURE PUBLIC SAFETY.

12. CONTRACTOR SHALL PROTECT TRAFFIC AT ALL TIMES DURING CONSTRUCTION. CONTRACTOR SHALL ERECT AND MAINTAIN TRAFFIC CONTROL DEVICES IN ACCORDANCE WITH THE APPROVED TRAFFIC CONTROL PLAN AND THE MUTCD (INCLUDING OREGON SUPPLEMENTS). ALL TRAFFIC CONTROL MEASURES SHALL BE APPROVED AND IN PLACE PRIOR TO ANY CONSTRUCTION ACTIVITY.

13. THE CONTRACTOR SHALL DEVELOP A LAYOUT FOR CONSTRUCTION, INCLUDING EXACT COMPONENT LOCATION, WORKING POINTS, LINES AND ELEVATIONS. PRIOR TO CONSTRUCTION, THE FIELD LAYOUT SHALL BE APPROVED BY THE ENGINEER.

14. ALL SURVEY AND STAKING NECESSARY FOR CONSTRUCTION SHALL BE PROVIDED BY THE CONTRACTOR. THE CONTRACTOR SHALL DEVELOP AND MAKE ALL DETAIL SURVEYS NECESSARY TO ESTABLISH PRINCIPAL LINES AND GRADES. SURVEY MONUMENTS ESTABLISHED FOR THE PROJECT ARE SHOWN ON THE PLANS.

GENERAL DEMOLITION NOTES

1. SEE SPECIFICATION SECTION 02 41 00 FOR ADDITIONAL REQUIREMENTS.

2. ITEMS NOTED FOR SALVAGE SHALL BE CAREFULLY REMOVED AND DELIVERED TO THE TRI-CITY WRRF. COORDINATE DELIVERY WITH OWNER.

3. THE CONTRACTOR SHALL REPORT ALL REMOVED EQUIPMENT TO OWNER FOR ASSET MANAGEMENT RECORDS.

4. REMOVE ALL PIPING, CONDUIT, SUPPORTS, AND ASSOCIATED MATERIALS FOR SYSTEMS AND EQUIPMENT THAT ARE BEING REMOVED.

5. SEE HVAC, ELECTRICAL AND CONTROLS SHEETS FOR ADDITIONAL DEMOLITION INFORMATION.

EROSION AND SEDIMENT CONTROL NOTES

1. WHEN RAINFALL AND RUNOFF OCCURS, DAILY INSPECTIONS OF THE EROSION AND SEDIMENT CONTROLS AND DISCHARGE OUTFALLS MUST BE PROVIDED BY SOMEONE KNOWLEDGEABLE AND EXPERIENCED IN THE PRINCIPLES, PRACTICES, INSTALLATION AND MAINTENANCE OF EROSION AND SEDIMENT CONTROLS WHO WORKS FOR THE PERMITTEE.

2. CONSTRUCTION ACTIVITIES MUST AVOID OR MINIMIZE EXCAVATION AND CREATION OF BARE GROUND FROM OCTOBER 1 THROUGH MAY 31 (WET WEATHER PERIOD) EACH YEAR.

3. DURING WET WEATHER PERIOD, TEMPORARY STABILIZATION OF THE SITE MUST OCCUR AT THE END OF EACH WORK DAY.

4. SEDIMENT CONTROLS MUST BE INSTALLED AND MAINTAINED ON ALL DOWN GRADIENT SIDES OF THE CONSTRUCTION SITE AT ALL TIMES DURING CONSTRUCTION. THEY MUST REMAIN IN PLACE UNTIL PERMANENT VEGETATION OR OTHER PERMANENT COVERING OF EXPOSED SOIL IS ESTABLISHED.

5. ALL ACTIVE INLETS MUST HAVE SEDIMENT CONTROLS INSTALLED AND MAINTAINED AT ALL TIMES DURING CONSTRUCTION. UNLESS OTHERWISE APPROVED, A SURFACE MOUNTED AND ATTACHABLE, U-SHAPED FILTER BAG IS REQUIRED FOR ALL CURB INLET CATCH BASINS.

6. SIGNIFICANT AMOUNTS OF SEDIMENT WHICH LEAVES THE SITE MUST BE CLEANED UP WITHIN 24 HOURS AND PLACED BACK ON THE SITE AND STABILIZED OR PROPERLY DISPOSED. THE CAUSE OF THE SEDIMENT RELEASE MUST BE FOUND AND PREVENTED FROM CAUSING A RECURRENCE OF THE DISCHARGE WITHIN THE SAME 24 HOURS. ANY IN-STREAM CLEAN UP OF SEDIMENT SHALL BE PERFORMED ACCORDING TO THE OREGON DEPARTMENT OF STATE LANDS REQUIRED TIME FRAME.

7. SEDIMENT MUST NOT BE INTENTIONALLY WASHED INTO STORM SEWERS, DRAINAGE WAYS OR WATER BODIES.

8. SEDIMENT MUST BE REMOVED FROM BEHIND ALL SEDIMENT CONTROL MEASURES WHEN IT HAS REACHED A HEIGHT OF 1/3RD THE BARRIER HEIGHT, AND PRIOR TO THE CONTROL MEASURES REMOVAL.

9. CLEANING OF ALL STRUCTURES WITH SUMPS MUST OCCUR WHEN THE SEDIMENT RETENTION CAPACITY HAS BEEN REDUCED BY 50% AND AT COMPLETION OF PROJECT.

10. ANY USE OF TOXIC OR OTHER HAZARDOUS MATERIALS MUST INCLUDE PROPER STORAGE, APPLICATION AND DISPOSAL.

11. THE PERMITTEE MUST PROPERLY MANAGE HAZARDOUS WASTES, USED OILS, CONTAMINATED SOILS, CONCRETE WASTE, SANITARY WASTE, LIQUID WASTE OR OTHER TOXIC SUBSTANCES DISCOVERED OR GENERATED DURING CONSTRUCTION.

12. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS. NUTRIENT RELEASES FROM FERTILIZERS TO SURFACE WATERS MUST BE MINIMIZED. TIME RELEASE FERTILIZERS SHOULD BE USED AND CARE SHOULD BE MADE IN APPLICATION OF FERTILIZERS WITHIN ANY WATER WAY RIPARIAN ZONE.

13. CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER INSTALLATION AND MAINTENANCE OF ALL EROSION SEDIMENT CONTROL MEASURES, IN ACCORDANCE WITH CURRENT WES STANDARDS AND STATE AND FEDERAL REGULATIONS.

14. PRIOR TO ANY LAND DISTURBING ACTIVITIES, THE BOUNDARIES OF THE CLEARING LIMITS, VEGETATED BUFFERS, AND ANY SENSITIVE AREAS SHOWN ON THIS PLAN SHALL BE CLEARLY DELINEATED IN THE FIELD. UNLESS OTHERWISE APPROVED, NO DISTURBANCE IS PERMITTED BEYOND THE CLEARING LIMITS. THE CONTRACTOR MUST MAINTAIN THE DELINEATION FOR THE DURATION OF THE PROJECT.
NOTE: VEGETATED CORRIDORS TO BE DELINEATED WITH ORANGE CONSTRUCTION FENCE OR APPROVED EQUAL.

15. PRIOR TO ANY LAND DISTURBING ACTIVITIES, THE BMPS THAT MUST BE INSTALLED ARE GRAVEL CONSTRUCTION ENTRANCE, PERIMETER SEDIMENT CONTROL AND INLET PROTECTION. THESE BMPS MUST BE MAINTAINED FOR THE DURATION OF THE PROJECT.

16. IF VEGETATIVE SEED MIXES ARE SPECIFIED, SEEDING MUST TAKE PLACE NO LATER THAN SEPTEMBER 1ST; THE TYPE AND PERCENTAGES OF SEED IN THE MIX AS IDENTIFIED ON THE PLANS OR AS SPECIFIED BY THE OWNER.

17. WATER-TIGHT TRUCKS MUST BE USED TO TRANSPORT SATURATED SOILS FROM THE CONSTRUCTION SITE. AN APPROVED EQUIVALENT IS TO DRAIN THE SOIL ON SITE AT A DESIGNATED LOCATION USING APPROPRIATE BMPS; SOIL MUST BE DRAINED SUFFICIENTLY FOR MINIMAL SPILLAGE.

18. ALL PUMPING OF SEDIMENT LADEN WATER MUST BE DISCHARGED OVER AN UNDISTURBED, PREFERABLY VEGETATED AREA, AND THROUGH A SEDIMENT CONTROL BMP (I.E. FILTER BAG).

19. THE ESC PLAN MUST BE KEPT ONSITE. ALL MEASURES SHOWN ON THE PLAN MUST BE INSTALLED PROPERLY TO ENSURE THAT SEDIMENT LADEN WATER DOES NOT ENTER A SURFACE WATER SYSTEM, ROADWAY OR OTHER PROPERTIES.

20. THE ESC MEASURES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE MEASURES SHALL BE UPGRADED AS NEEDED TO MAINTAIN COMPLIANCE WITH ALL REGULATIONS.

21. WRITTEN ESC LOGS ARE SUGGESTED TO BE MAINTAINED ONSITE AND AVAILABLE TO OWNER INSPECTORS UPON REQUEST.

22. IN AREAS SUBJECT TO WIND EROSION, APPROPRIATE BMPS MUST BE USED WHICH MAY INCLUDE THE APPLICATION OF FINE WATER SPRAYING, PLASTIC SHEETING, MULCHING OR OTHER APPROVED MEASURES.

23. ALL EXPOSED SOILS MUST BE COVERED DURING WET WEATHER PERIOD.

ABBREVIATIONS

AB	ANCHOR BOLT
ABAN(D)	ABANDON(ED)
AC	ASPHALTIC CONCRETE
ACP	ASPHALTIC CONCRETE PAVEMENT
ADWF	AVERAGE DRY WEATHER FLOW
AHU	AIR HANDLING UNIT
AL	ALUMINUM
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATELY
APPVD	APPROVED
ARV	AIR RELEASE VALVE
ASPH	ASPHALT(IC)
ASSY	ASSEMBLY
AWWA	AMERICAN WATER WORKS ASSOCIATION
BC	BOTTOM OF CURB
BCR	BEGIN CURB RETURN
BETW	BETWEEN
BFILL	BACKFILL
BL	BIKE LANE
BLDG	BUILDING
BMPS	BEST MANAGEMENT PRACTICES
BOW	BACK OF WALK
BRK	BREAK
BTM	BOTTOM
BV	BALL VALVE
C&G	CURB AND GUTTER
CARV	COMBINATION AIR RELEASE VALVE
CB	CATCH BASIN
CCP	CONCRETE CYLINDER PIPE
CDF	CONTROLLED DENSITY FILL
CFM	CUBIC FEET PER MINUTE
CI	CAST IRON
CIPP	CAST IN PLACE PIPE
CJ	CONTROL JOINT
CL	CENTER LINE / CLASS
CLR	CLEARANCE
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CHKV	CHECK VALVE
CND	CONDUIT
COM	COMMUNICATIONS
CONC	CONCRETE
CONST	CONSTRUCT(ION)
COORD	COORDINATE
COP	COPPER
CPLG	COUPLING
CR	CRUSHED ROCK
CSP	CONCRETE SEWER PIPE
CY	CUBIC YARD
D	DRAIN
DET	DETAIL
DFL	DOUGLAS FIR LARCH
DI	DUCTILE IRON
DIA	DIAMETER
DIM	DIMENSION
DISC	DISCONNECT
DP	DIAMOND PLATE
DWG	DRAWING
DWY	DRIVEWAY
E	EXPOSURE / EAST
EA	EACH
ECC	ECCENTRIC
ECR	END CURB RETURN
EF	EXHAUST FAN
EL/ELEV	ELEVATION
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EOR	ENGINEER OF RECORD
ESC	EROSION SEDIMENT CONTROL
EXIST/ EXST	EXISTING
EXT	EXTERNAL
FAB	FABRICATE (D)
FDN	FOUNDATION
FITG	FITTING
FIN	FINISH
FLG	FLANGE
FO	FIBER OPTIC
FRP	FIBERGLASS REINFORCED PRODUCT
FT	FOOT/FEET
FTG	FOOTING
G	GAS
GALV	GALVANIZED
GPM	GALLONS PER MINUTE
GR	GRADE
GRP	GROOVED PIPE
GRVL	GRAVEL
GV	GATE VALVE
HDPE	HIGH DENSITY POLY ETHYLENE
HGT	HEIGHT
HMAC	HOT MIX ASPHALT CONCRETE
HP	HORSEPOWER
HPT	HIGH POINT
HWY	HIGHWAY
IE	INVERT ELEVATION
INSTL	INSTALL
IRR	IRRIGATION
INTX	INTERSECTION
JT(S)	JOINT(S)
KW	KILOWATT
L	LOUVER
LF	LINEAR FOOT
LOC	LOCATION
LPT	LOW POINT
LS	LONG SLEEVE
LT	LEFT
LVC	LENGTH OF VERTICAL CURVE
MATL	MATERIAL
MAX	MAXIMUM
MB	MAILBOX
MECH	MECHANICAL
MET	METAL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MJ	MECHANICAL JOINT
MUTCD	MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES
NTS	NOT TO SCALE
NIC	NOT IN CONTRACT
NWN	NORTHWEST NATURAL GAS
OC	ON CENTER
OD	OUTSIDE DIAMETER
ODOT	OREGON DEPARTMENT OF TRANSPORTATION
OF	OVERFLOW
OVHD	OVERHEAD LINE
PC	POINT OF CURVATURE
PCC	PORTLAND CEMENT CONCRETE
PE	PLAIN END
PERF	PERFORATED
PERP	PERPENDICULAR
PGE	PORTLAND GENERAL ELECTRIC
PK	PARKING
PL	PROPERTY LINE
PROP	PROPOSED
PS	PUMP STATION
PSI	POUNDS PER SUARE INCH
PT	POINT OF TANGENCY
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVI	POINT OF VERTICAL CURVATURE
PVMT	PAVEMENT
PW	PUBLIC WORKS
QA	QUALITY ASSURANCE
QC	QUALITY CONTROL
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDCR	REDUCER
RDWY	ROADWAY
REINF	REINFORCE(D)(ING)(MENT)
REQ'D	REQUIRED
RESTR	RESTRAIN(ED)
RFCA	RESTRAINED FLANGE COUPLING ADAPTOR
RFP	REINFORCED FIBERGLASS PRODUCTS
RT	RIGHT
RTL	RIGHT TURN LANE
R/W, ROW	RIGHT OF WAY
SA	SUPPLY AIR
SCH	SCHEDULE
SDMH	STORM DRAIN MANHOLE
SF	SUPPLY FAN
SHT	SHEET
SLP	SLOPE
SLV	SLEEVE
SPECS	SPECIFICATIONS
SP	STATIC PRESSURE
SPL	SPOOL
SSCO	SANITARY SERVICE CLEANOUT
SSMH	SANITARY SEWER MANHOLE
SST	STAINLESS STEEL
STA	STATION
STL	STEEL
STD	STANDARD
S/W	SIDEWALK
T	THERMOSTAT
TDH	TOTAL DESIGN HEAD
TEMP	TEMPORARY
THK	THICK/THICKNESS
THRD	THREADED
THRU	THROUGH
TRANS	TRANSITION
TYP	TYPICAL
UH	UNIT HEATER
UG	UNDERGROUND
UGP	UNDERGROUND POWER
VARS	VARIES
VERT	VERTICAL(LY)
VV	VALVE VAULT
W	WATER
W/	WITH
W/IN	WITHIN
W/O	WITHOUT
WES	WATER ENVIRONMENT SERVICES
WQ	WATER QUALITY
WRRF	WATER RESOURCE RECOVERY FACILITY

NO.	DATE	REVISION	BY

SHEET 3-G3 3 of 184

DESIGNED: DWK
DRAWN: MBE
CHECKED: EPK
APPROVED: NSL

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98128PE — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

REGISTERED LANDSCAPE ARCHITECT — OREGON — LA001 — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

SCALE: VERT: AS SHOWN; HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GENERAL NOTES, ESC NOTES, AND ABBREVIATIONS

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabiltation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-G.dwg 3-G3 5/1/2025 10:22 AM JACOB.COLES 24.1s (LMS Tech)

PIPE & FITTING SYMBOLS

PLANT	SCHEMATIC	
		WELDED JOINT
		FLANGED JOINT
		MECHANICAL JOINT
		PUSH-ON JOINT (RUBBER GASKET)
		FLANGED COUPLING ADAPTER
		FLEXIBLE COUPLING W/ THRUST RING
		90° BEND UP
		90° BEND DOWN
		TEE UP
		TEE DOWN
		LATERAL UP
		LATERAL DOWN
		CONCENTRIC REDUCER
		ECCENTRIC REDUCER
		UNION
		BLIND FLANGE
		CAP
		LONG SLEEVE
		FLEXIBLE COUPLING
		FITTING (45°)

VALVE SYMBOLS

PLANT	SCHEMATIC	
		GATE VALVE
		BALL VALVE
		PLUG VALVE
		CHECK VALVE
		SWING CHECK VALVE
		DOUBLE CHECK ASSEMBLY
S		SOLENOID VALVE
		HOSE VALVE
		REDUCED PRESSURE BACKFLOW PREVENTER W/ GATE VALVES
		HOSE BIBB

MISCELLANEOUS PIPING SYMBOLS

PRESSURE GAUGE ASSEMBLY

PRESSURE GAUGE & TRANSMITTER ASSEMBLY

METER

HVAC SYMBOLS

FAN

GRILLE

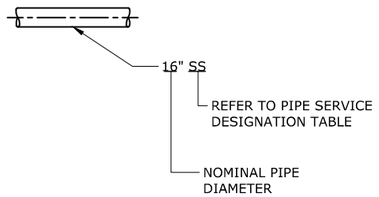
PIPE SERVICE DESIGNATION

DR	DRAIN TO SANITARY
SSFM	SANITARY SEWER FORCE MAIN (PRESSURE)
WS	WATER SERVICE, BURIED

PIPE MATERIAL SCHEDULE

DR	PVC D3034
SSFM	DI CLASS PER SPECS
WS	PEX

PIPE SERVICE LABEL

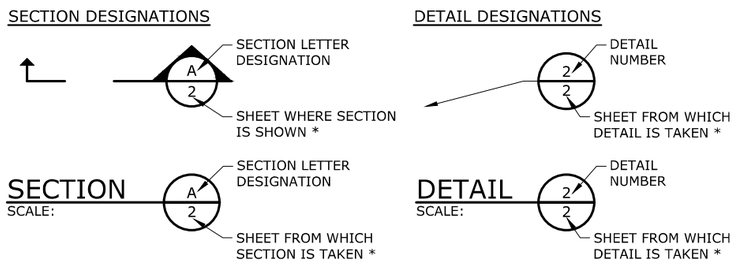


TOPOGRAPHIC LEGEND

	EXISTING	PROPOSED
WATERLINE	10"W	12" W
ELECTRICITY	E	E
GAS	4"G	
TELEPHONE/TELEMETRY	T	
CABLE TELEVISION	CATV	
SANITARY SEWER LINE	8"SS	8"SS
SANITARY SEWER FORCE MAIN	6"SSFM	6"SSFM
STORM DRAIN	8"SD	8"SD
CULVERT		18"D
SAWCUT		
ABANDON STRUCTURE OR PIPE		
REMOVE STRUCTURE OR PIPE		
DRAINAGE DITCH		
TREE PROTECTION		
CHAIN LINK FENCE		
SEDIMENT FENCING		
STRAW WATTLES		
GUARDRAIL		
ROCK WALL		
TREE/BUSH LINE		
CENTERLINE		
EASEMENT/PROPERTY LINE		
RIGHT-OF-WAY		
EDGE OF PAVEMENT/AC		
EDGE OF GRAVEL		
CURB		
SIDEWALK	S/W	
STRUCTURE OR FACILITY		
NON-JURISDICTIONAL WETLAND		
JURISDICTIONAL WETLAND		
CONTOUR MINOR	199	199
CONTOUR MAJOR	200	200
AC REMOVAL		
AREA OF DEMOLITION		

	EXISTING	PROPOSED
MANHOLE		
CLEAN-OUT		
CATCH BASIN		
THRUST BLOCK		
VALVE		
REDUCER		
BLOW-OFF ASSEMBLY		
AIR RELEASE ASSEMBLY		
FIRE HYDRANT ASSEMBLY		
WATER METER		
PULL BOX/JUNCTION BOX		
UTILITY POLE		
GUY WIRE		
LIGHT POST		
MAILBOX		
SIGN		
BENCHMARK		
TREE DECIDUOUS		
TREE CONIFEROUS		
TREE TO BE REMOVED		
SURFACE ELEVATION	+ 176.63	+ 176.63
INLET PROTECTION		

SECTION AND DETAIL DESIGNATIONS



* NOTE: IF PLAN AND SECTION OR DETAIL CALL-OUT AND DETAIL ARE SHOWN ON THE SAME DRAWING, DRAWING NUMBER IS REPLACED WITH A DASH.

SHEET 3-G4 4 of 184

REVISION | BY | NO. | DATE

DESIGNED: DWK
DRAWN: MBE
CHECKED: EPK
APPROVED: NSL

OREGON REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas S. Lafrenz Date: 12/31/26

OREGON REGISTERED LANDSCAPE ARCHITECT Nicholas S. Lafrenz RENEWS 12-31-26

SCALE | VERT.: AS SHOWN | HORIZ.: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

CIVIL AND MECHANICAL LEGEND AND SYMBOLS

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-G.dwg 3-G4 5/1/2025 10:22 AM JACOB.COLES 24.1s (LMS Tech)

ELECTRICAL PLAN SYMBOLS

- SINGLE RECEPTACLE, 240V
- 30 — NONFUSED DISCONNECT SWITCH, AMPERAGE INDICATED
- F, 40/60 — FUSED DISCONNECT SWITCH (40/60 40=FUSE AMPERAGE, 60=SWITCH AMPERAGE)
- $M — MOTOR RATED, 3P, 30A, DISCONNECT SWITCH
- MANUAL MOTOR STARTER
- COMBINATION MOTOR STARTER
- FLAME DETECTOR
- GAS DETECTOR
- CONDUIT TURNING DOWN FROM KEY ELEVATION
- CONDUIT TURNING UP FROM KEY ELEVATION
- CONDUIT CAP
- BELOW GRADE CONDUIT
- ABOVE GRADE CONDUIT
- CONDUIT RUN, BROKEN AND CONTINUED ON SAME SHEET OR AS NOTED
- XXX — HOME RUN, ELECTRICAL PANEL DESTINATION SHOWN.
- INDICATES REMOVAL OR DEMOLITION
- P1 — ELECTRICAL CIRCUIT IDENTIFICATION
- P1 P2 / C1 C2 — MULTIPLE ELECTRICAL CIRCUITS, SEPARATE CONDUITS
- 1"C — P1 P2 / P3 P4 — MULTIPLE ELECTRICAL CIRCUITS, COMMON CONDUIT (SIZE SHOWN)
- CONDUIT SEAL-OFF
- INSTRUMENT LOCATION
- WELDING RECEPTACLE
- RECEPTACLE, 480V
- CONTROL STATION
- M OR M — MOTOR
- POWER POLE WITH GUY WIRE
- FLEXIBLE CONDUIT
- CONDUIT SEAL
- T — TRANSFORMER
- JB — JUNCTION BOX
- F — FAN (SUPPLY/EXHAUST)
- T — THERMOSTAT

GROUNDING PLAN SYMBOLS

- GROUND ROD
- GROUND TEST WELL
- GROUND CONNECTION TO EQUIPMENT DETAIL CALLOUT SHOWN ON PLAN DWG.
- GROUND CONNECTION, DETAIL CALLOUT SHOWN ON PLAN DWG.
- GROUND CONNECTION TO REBAR, DETAIL CALLOUT SHOWN ON PLAN DWG.
- BELOW GRADE #4/0 AWG BARE COPPER FOR MAIN PLANT GROUND
- BELOW GRADE #2/0 AWG INSULATED COPPER FOR GROUND TAP.
- ABOVE GRADE #2/0 AWG INSULATED GROUND TAP
- CONDUIT STUB UP

ONE-LINE SYMBOLS

- 30/150AT MCP — CIRCUIT BREAKER, MAGNETIC TRIP ONLY (MOTOR CIRCUIT PROTECTOR) CURRENT/TRIP SHOWN, 3 POLE UNLESS UNLESS INDICATED OTHERWISE
- 250 / 250/400 — CIRCUIT BREAKER, THERMAL MAGNETIC OR SOLID STATE TRIP OR TRIP/FRAME SHOWN, 3 POLE UNLESS INDICATED OTHERWISE
- 200 — FUSED DISCONNECT SWITCH, SWITCH CURRENT RATING INDICATED, 3 POLE UNLESS INDICATED OTHERWISE
- 250 — CIRCUIT BREAKER, RATING INDICATED, SOLID STATE TRIP, DRAW-OUT TYPE
- FUSED SWITCH
- 200 — FUSE, RATING INDICATED
- 30 — NON-FUSED DISCONNECT, RATING INDICATED
- VFD — VARIABLE FREQUENCY DRIVE
- SSRV — SOFT START REDUCED VOLTAGE
- XFMR NAME / KVA / VOLTAGE(120V-240V-480V-4160V-12.247V) / PHASE(1Ø/3Ø), 3W/4W / Z%=XXX / A FAULT= XXXA
- UNGROUNDED DELTA
- GROUNDED DELTA
- OPEN DELTA
- GROUNDED WYE
- PLUG
- M — POWER MONITOR
- G — EMERGENCY STANDBY ENGINE GENERATOR, RATING AS INDICATED ON ONE-LINE DIAGRAM
- X / X — MOTOR, X: SIZE IN HP
- X — PILOT LIGHT, SUBSCRIPT INDICATES COLOR
- X — PUSH-TO-TEST INDICATING LIGHT, SUBSCRIPT INDICATES COLOR

  A=AMBER R=RED
  B=BLUE N=NEON
  C=CLEAR W=WHITE
  G=GREEN Y=YELLOW
- EARTH GROUND
- LOAD
- CURRENT TRANSFORMER
- VOLTAGE TRANSFORMER
- N, E, L, S/N — AUTOMATIC TRANSFER SWITCH W/SOLID NEUTRAL
- BP — CONTACTOR (BYPASS)
- MOTOR STARTER
- MANUAL TRANSFER SWITCH
- SPD — SURGE PROTECTIVE DEVICE

LIGHTING PLAN SYMBOLS

- $X — WALL SWITCH, SUBSCRIPT INDICATES TYPE

  2=DOUBLE POLE
  3=THREE WAY
  4=FOUR WAY
  D=DIMMER
  TH=THERMAL SWITCH
  T=TIMED SWITCH
  LV=LOW VOLTAGE
  P=PILOT LIGHT
  K=KEY OPERATED
  WP=WEATHER PROOF
  M=MOTOR RATED SWITCH
- X — SINGLE RECEPTACLE, 120V
- X — DUPLEX RECEPTACLE, 120V
- X — 4-PLEX RECEPTACLE, 120V

  RECEPTACLE, SUBSCRIPT INDICATES TYPE
  WP =WEATHER PROOF
  GFI = GROUND FAULT CIRCUIT INTERRUPTER
  IG = ISOLATED GROUND
  AFC = ARC FAULT CIRCUIT INTERRUPTER
  GFPE = GROUND FAULT EQUIPMENT PROTECTION
- EXIT SIGN - WALL MOUNTED
- EXIT SIGN - 2 SIDED CEILING MOUNTED
- P — PHOTOCELL
- M — MOTION SENSOR
- LOW BAY LIGHT LED FIXTURE SURFACE MOUNT
- LOW BAY LED LIGHT FIXTURE (NEMA 4X)
- HIGH BAY LIGHT LED FIXTURE SURFACE MOUNT
- WALL MOUNT FIXTURE
- EMERGENCY EXIT LIGHT
- FLOOD LIGHT
- STANCHION FIXTURE - POLE OR STRUT MOUNT
- STANCHION FIXTURE - WALL MOUNT

MISCELLANEOUS SYMBOLS

- BELL
- BUZZER
- HORN
- X — METER
  SUBSCRIPT INDICATES TYPE
  A=AMP V=VOLT
  W=WATT VAR=VOLT-AMP REACTIVE
- BATTERY
- CHASSIS GROUND
- RECEPTACLE
- PHONE OUTLET (RJ12)
- D — DATA COMPUTER (RJ45)
- HEATER
- HAND SWITCH
- R, G — GO / NO-GO / ALARM
- SCADA/YAGI ANTENNA
- IP CAMERA (PTZ OR OTHER)

DUCT BANK SYMBOLS

- CONDUIT
- CONDUIT DUCT BANK OUTLINE
- UTILITY EQUIPMENT CLEARANCE AREA

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

SHEET 3-G5 5 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2026 MICHAEL E. WALLIS
EXPIRES: 6/30/26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

ELECTRICAL LEGEND, SYMBOLS AND ABBREVIATIONS

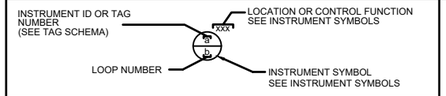
consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

P:\Projects\20.18.02_MSA_WES_Final_Design\DWG\Group 3\3-G5-Electrical Legend, symbols, & Abbrev.dwg 3-G5 5/5/2025 6:05 PM ROBERTC 23.1s (LMS Tech)

INSTRUMENTATION CALL-OUT



INSTRUMENT SYMBOLS

	PRIMARY LOCATION ACCESSIBLE (1)	PRIMARY LOCATION INACCESSIBLE (2)	FIELD MOUNTED	AUXILIARY LOCATION ACCESSIBLE (1)	AUXILIARY LOCATION INACCESSIBLE (2)
INSTRUMENT	a/b *	a/b *	a/b *	a/b *	a/b *
SHARED DISPLAY SHARED CONTROL	a/b	a/b	a/b	a/b	a/b
COMPUTER FUNCTION	a/b *	a/b *	a/b *	a/b *	a/b *
PROGRAMMABLE LOGIC CONTROL	a/b	a/b	a/b	a/b	a/b

(1) NORMALLY ACCESSIBLE TO OPERATOR

(2) NORMALLY INACCESSIBLE TO OPERATOR (BEHIND-THE-PANEL)

* LOCATION OR CONTROL FUNCTION - SEE BELOW

A INSTRUMENT IDENTIFICATION/TAG NUMBER (SEE TAG DESIGNATION FOR MORE INFO)

B INSTRUMENT LOOP NUMBER

SINGLE INSTRUMENT OR OTHER COMPONENT HAVING MULTIPLE FUNCTIONS

RELAY INTERLOCK LOGIC - SEE SCHEMATICS OR SPECIFICATIONS FOR MORE INFORMATION

INDICATING LIGHT - FIELD MOUNTED, MAY BE LOCATED ON A CONTROL PANEL

INDICATING LIGHT - PANEL MOUNTED

CR CONTROL RELAY

LIGHTNING SURGE ARRESTOR

CONTROL FUNCTION DESIGNATIONS

XXX DESIGNATIONS SUCH AS 100 (LOCAL CONTROL PANEL NO 100), 200 (LOCAL CONTROL PANEL NO 200), ETC., ARE USED WHEN NECESSARY TO SPECIFY INSTRUMENT OR FUNCTION LOCATION.

AHC	AUTO/HOLD/CLOSE
AM	AUTO/MANUAL
AS	AIR SUPPLY
DEV	DEVIATION
HML	HIGH/MID/LOW
HOA	HAND/OFF/AUTO
HOR	HAND/OFF/REMOTE
LOR	LOCAL/OFF/REMOTE
LOS	LOCKOUT STOP
LR	LOCAL/REMOTE
MOA	MANUAL/OFF/AUTO
OC	OPEN/CLOSE
OCA	OPEN/CLOSE/AUTO
OLH	OFF/LOW/HIGH
OO	ON/OFF
OSC	OPEN/STOP/CLOSE
PID	PROPORTIONAL/INTEGRAL/ DERIVATIVE
POT	POTENTIOMETER
RL	RAISE/LOWER
RSL	RAISE/STOP/LOWER
SD	SHUTDOWN
SEL	SELECT
SP	SET POINT
SR	START/RESET
SS	START/STOP
ST	START
STR	STOP/RESET

INSTRUMENT SYMBOLS - CONT

COMPUTING OR CONVERTING FUNCTIONS

COMPUTING

SUMMING	DERIVATIVE	EXPONENTIAL
ADDITION	AVERAGING	BIAS
SUBTRACTION	RATIO	HIGH LIMITING
MULTIPLYING	DIFFERENCE	LOW LIMITING
DIVIDING	HIGH SELECTING	LINEARIZER
SQ ROOT EXTRACTION	LOW SELECTING	
PROPORTIONAL	INTEGRAL	

CONVERTING

E	VOLTAGE	R	RESISTANCE (ELECT)	A	ANALOG
I	CURRENT	D	DIGITAL	B	BINARY
P	PNEUMATIC	O	ELECTROMAGNETIC, SONIC	H	HYDRAULIC

*PLC / REMOTE I/O POINTS

ANALOG INPUT

DISCRETE INPUT

DATA SIGNAL INPUT*

ANALOG OUTPUT

DISCRETE OUTPUT

DATA SIGNAL OUTPUT*

* 2-WIRE NETWORK INTERFACE. SEE SPECIFICATION FOR MORE INFORMATION

INSTRUMENTATION LINE SYMBOLOGY

NEW WORK (UNSCREENED)

EXISTING (SCREENED)

EXISTING TO BE DEMOLISHED

INSTRUMENT LINES

CAPILLARY

DATA LINK

ELECTRIC (PULSE SIGNAL)

ELECTRICAL SIGNAL

ULTRASONIC SIGNAL

HYDRAULIC SIGNAL

MECHANICAL LINK

PNEUMATIC SIGNAL

PROCESS

OTHER INSTRUMENTATION SYMBOLS AND SYMBOLOGY

24 VDC POWER SUPPLY (SIZE AS NOTED)

AS AIR SUPPLY

PRIMARY ELECTRICAL POWER (120V/60HZ UNLESS INDICATED OTHERWISE)

INDICATES VENDOR FURNISHED EQUIPMENT

CABLE (MULTICONDUCTOR OR COAXIAL) FURNISHED WITH EQUIPMENT

(E) EXISTING EQUIPMENT

(F) FUTURE EQUIPMENT

(R) RELOCATED EQUIPMENT

TAG SCHEMA

FIRST LETTER — TIC 01 — SUCCEEDING LETTER(S)

RUN INDICATION SHALL BE RED, OFF INDICATION SHALL BE GREEN

TYPICAL TAG FORMAT

PAH 0101 — INSTRUMENT TAG NUMBER
PAH — FUNCTIONAL IDENTIFICATION
P — FIRST LETTER
AH — SUCCEEDING LETTER(S)
01 — EQUIPMENT NUMBER
01 — LOOP NUMBER

EXPANDED TAG FORMAT

RAW 10 PAH 0101A — INSTRUMENT TAG NUMBER
RAW — PROCESS
10 — AREA / BUILDING NUMBER
PAH — FUNCTIONAL IDENTIFICATION
P — FIRST LETTER
AH — SUCCEEDING LETTER(S)
01 — EQUIPMENT NUMBER
01 — LOOP NUMBER
A — OPTIONAL SUFFIX

	FIRST LETTER		SUCCEEDING LETTER(S)		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION				
C	CONDUCTIVITY			CONTROL	CLOSED
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	GAGE		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOTOR	MOMENTARY			MIDDLE, INTERMEDIATE
N	TORQUE		ISOLATE	ISOLATOR	
O			ORIFICE, RESTRICTION		OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	INTRUSION	X AXIS			
Y	EVENT, STATE, OR PRESENCE	Y AXIS		COMPUTER, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, FINAL CONTROL ELEMENT	

EQUIPMENT SYMBOLS

CENTRIFUGAL PUMP

BLOWER OR FAN

SUBMERSIBLE LEVEL SENSOR

FLOAT SWITCH

M MAGNETIC FLOW METER

OTHER SYMBOLS

IB INTRINSIC SAFETY BARRIER

ABBREVIATIONS

FOC	FIBER OPTIC CABLE
FOR	FIBER OPTIC REPEATER
FOT	FIBER OPTIC TRANSCEIVER
HMI	HUMAN MACHINE INTERFACE
LCP	LOCAL CONTROL PANEL
LCS	LOCAL CONTROL STATION
MCC	MOTOR CONTROL CENTER
MCP	MAIN CONTROL PANEL
MOV	MOTOR OPERATED VALVE
MS	MOTOR STARTER
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OI	OPERATOR INTERFACE
PC	PERSONAL COMPUTER
PLC	PROGRAMMABLE LOGIC CONTROLLER
RIO	REMOTE I/O
RVSS	REDUCED VOLTAGE SOLID-STATE STARTER
RTU	REMOTE TERMINAL UNIT
SW	SEAL WATER
TC	THERMOCOUPLE
TSP	TWISTED SHIELD PAIR
UPS	UNINTERRUPTABLE POWER SUPPLY
VCP	VENDOR SUPPLIED PANEL
VFD	VARIABLE FREQUENCY DRIVE
VSD	VARIABLE SPEED DRIVE

GENERAL INSTRUMENTATION NOTES

1. ADDITIONAL INSTRUMENTATION AND CONTROL SYMBOLS MAY BE USED AS REQUIRED. SYMBOLS AND NOMENCLATURE ARE BASED ON ISA STANDARD 5.1-INSTRUMENTATION SYMBOLS AND IDENTIFICATION.
2. SEE GENERAL SHEETS FOR ADDITIONAL SYMBOLS AND ABBREVIATIONS.
3. SEE SPECIFICATION SECTION 409100 FOR COMPLETE DETAILS OF LOOP DRAWING SUBMITTAL REQUIREMENTS.
4. POWER SUPPLIES FOR INSTRUMENT LOOPS OR SYSTEMS SHALL BE FURNISHED BY THE INSTRUMENTATION SUPPLIER TO MEET THE VOLTAGE AND CURRENT REQUIREMENTS OF THE COMPONENTS IN EACH LOOP OR SYSTEM.
5. VALVE ACTUATORS SHALL BE SUPPLIED WITH THE VALVE BY THE VALVE SUPPLIER, UNLESS OTHERWISE NOTED. ALL 480VAC MOTOR ACTUATORS SHALL BE SUPPLIED WITH A LOCAL DISCONNECT SWITCH.

NO.	DATE	REVISION	BY

SHEET 3-G6 6 of 184

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

INSTRUMENTATION LEGEND, SYMBOLS AND ABBREVIATIONS

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

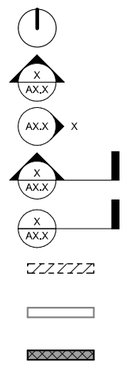
PORTLAND Engineering Inc.

C:\AutoCAD Projects\V255 WES Pump Station Design\South Welches\S_Welches_SYM.dwg 3-G6 5/5/2025 12:51 PM PEI 24.0s (LMS Tech)

ARCHITECTURAL ABBREVIATIONS

ABV	ABOVE
ACC	ACCESSORY
ADD'L	ADDITIONAL
AFF	ABOVE FINISH FLOOR
BLKG	BLOCKING
CLR	CLEAR
CLST	CLOSET
C.I.	CONTINUOUS INSULATION
C.J.	CONTROL JOINT
DBL	DOUBLE
DN	DOWN
℄	CENTERLINE
CFCI	CONTRACTOR FURNISHED CONTRACTOR INSTALLED
CONC	CONCRETE
CONT	CONTINUOUS
CPT	COMMON PATH OF TRAVEL
DEMO	DEMOLISH/DEMOLITION
DS	DOWNSPOUT
(E)	EXISTING
EQ	EQUAL
EN	END NAIL
ETD	EXIT TRAVEL DISTANCE
EXT	EXTERIOR
FD	FLOOR DRAIN
FLR	FLOOR
GC	GENERAL CONTRACTOR
GYP	GYPSUM WALL BOARD
HT	HEIGHT
HR	HOUR
INFO	INFORMATION
INT	INTERIOR
LYR	LAYER
MAX	MAXIMUM
MFR	MANUFACTURER
MIN	MINIMUM
(N)	NEW
NOM	NOMINAL
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NRCA	NATIONAL ROOFING CONTRACTORS ASSOCIATION
OFOI	OWNER FURNISHED OWNER INSTALLED
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
PRE-MFR	PRE-MANUFACTURED
PT	PRESSURE TREATED
REQ	REQUIRED
SIMP	SIMPSON
SOG	SLAB ON GRADE
T.O.	TOP OF
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VFY	VERIFY
VOS	VERIFY ON SITE
WIN	WINDOW
WRB	WEATHER RESISTIVE BARRIER

LEGEND



GENERAL ARCHITECTURAL NOTES

1. COMPLY WITH ALL JURISDICTION EROSION CONTROL REQUIREMENTS.
2. CONTRACTOR SHALL VERIFY AND COORDINATE ALL NEW AND EXISTING CONDITIONS AND DIMENSIONS AT JOB SITE FOR COMPARISON WITH DRAWINGS AND SPECIFICATION PRIOR TO START OF AND DURING CONSTRUCTION. IF ANY DISCREPANCIES, INCONSISTENCIES, OR OMISSIONS ARE FOUND, THE ARCHITECT SHALL BE NOTIFIED, IN WRITING, FOR CLARIFICATION PRIOR TO PROCEEDING WITH WORK.
3. CONTRACTOR IS RESPONSIBLE FOR REVIEWING AND COORDINATING INFORMATION SHOWN ON ARCHITECTURAL AND STRUCTURAL DRAWINGS. IF ANY DISCREPANCIES ARE FOUND, ALERT ARCHITECT, IN WRITING, IMMEDIATELY.
4. CONTRACTOR SHALL ADHERE TO ALL CODES, AND REGULATIONS GOVERNING BUILDING ACCESS AND THE USE OF FACILITIES AS SET BY FEDERAL, STATE, AND LOCAL CODES, THE JURISDICTION HAVING AUTHORITY AND THE BUILDING OWNER.
5. DO NOT SCALE DRAWINGS. CONTRACTOR SHALL RELY ON WRITTEN DIMENSION AS GIVEN. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT FOR CLARIFICATIONS. ALL DIMESIONS SHALL BE FIELD VERIFIED BY CONTRACTOR AND COORDINATED WITH ALL WORK OF ALL TRADES. IF DESCEPANCIES ARE FOUND, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT, IN WRITING, FOR CLARIFICATION BEFORE THE COMMENCEMENT OR RESUMPTION OF WORK.
6. ALL STANDARD CONSTRUCTION SHALL CONFORM TO THE STANDARD DETAILS EXCEPT AS EXPLICITLY SUPERSEDED BY SPECIFIC DESIGN DETAILS GIVEN.
7. LARGE SCALE DRAWINGS TAKE PRECEDENCE OVER SMALL SCALE DRAWINGS AT ALL TIMES EXCEPT AS OTHERWISE NOTED.
8. THE CONTRACTOR SHALL FURNISH ALL MATERIALS, LABOR, EQUIPMENT, TRANSPORTATION AND SERVICES NECESSARY FOR THE SATISFACTORY COMPLETION OF WORK UNLESS DESIGNATED (NIC) OR (OFOI) OR (OFCI).
9. CONTRACTOR SHALL COMPLY, OBTAIN, AND PAY FOR ALL REQUIRED FEES, PERMITS, AND INSPECTIONS ASSESSED BY ANY GOVERNMENTAL AGENCY OR UTILITY COMPANY.
10. CONTRACTOR AND THEIR SUBCONTRACTOR(S) SHALL TAKE CAUTION WHEN WORKING AROUND THE EXISTING UTILITIES AND UNDERGROUND LINES.
11. AT ALL TIMES THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS OF THE JOB SITE, INCLUDING THE SAFETY OF PERSONS AND PROPERTY. DESIGN ADEQUACY AND SAFETY OF ERECTION BRACING, SHORING, TEMPORARY SUPPORT, ETC. THE ARCHITECT'S JOB SITE REVIEW IS NOT INTENDED TO INCLUDE REVIEW OF ADEQUACY OR THE CONTRACTOR'S SAFETY MEASURES.
12. THE CONTRACTOR SHALL WARRANT THAT ALL MATERIALS AND WORKMANSHIP ARE IN COMPLIANCE WITH THE DRAWINGS AND SPECIFICATIONS, AND ALL CHANGES HAVE THE APPROVAL OF THE ARCHITECT.
13. THE CONTRACTOR IS RESPONSIBLE TO COMPARE AND COORDINATE ALL DRAWINGS FOR PROPER FIT AND ATTACHMENT OF ALL PARTS. DETAILS NOT SHOWN, NOR DETAILED ON DRAWINGS, NOR CALLED FOR IN THESE NOTES SHALL BE CONSTRUCTED TO SAME SIZE AND CHARACTER AS FOR SIMILAR CONDITIONS WHICH ARE SHOWN, DETAILED SPECIFICATIONS, OR COMMONLY CONSTRUCTED IN THE INDUSTRY.
14. ABBREVIATIONS THROUGHOUT THE PLANS ARE THOSE IN COMMON USE. NOTIFY THE ARCHITECT OF ANY ABBREVIATIONS IN QUESTION.
15. THE CONTRACTOR SHALL VERIFY ALL ELECTRICAL AND PLUMBING ROUGH-IN LOCATIONS FOR ANY SPECIAL EQUIPMENT WITH THE SUPPLIER OF SUCH EQUIPMENT.
16. THE CONTRACTOR SHALL COORDINATE HIS WORK WITH THAT OF THEIR SEPARATE SUBCONTRACTORS SUCH AS WINDOWS, ETC. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION AND REQUIRED CLEARANCES OF THE EQUIPMENT. NO STRUCTURAL MEMBER SHALL BE OMITTED, NOTCHED, CUT, BLOCKED OUT, OR RELOCATED WITHOUT PRIOR APPROVAL BY THE ARCHITECT OR ENGINEER.
17. THE CONTRACTOR OF EACH TRADE SHALL KEEP THE PREMISES CLEAN AT ALL TIMES AND SHALL REMOVE ALL RUBBISH AS OFTEN AS REQUIRED FOR THE CONSTRUCTION AND FOR CONVENIENCE OF THE OWNER.
18. PROTECTIVE MEASURES SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT ADJACENT PROPERTY AT ALL TIMES DURING CONSTRUCTION INCLUDING MEASURES NEEDED SO AS NOT TO CAUSE ANY MUD, SILT, OR DEBRIS DEPOSITS ONTO PUBLIC OR PRIVATE PROPERTY.
19. ALL TEMPORARY BRACING AND SHORING SHALL BE DESIGNED TO SUSTAIN ALL LOADS ABD SOIL PRESSURE TO WHICH THE STRUCTURE MAY BE SUBJECTED.
20. IF THE CONTRACTOR ASCERTAINS AT ANY TIME THAT REQUIREMENTS OF THIS CONTRACT CONFLICT WITH, OR ARE IN VIOLATION OF, APPLICABLE LAWS, CODES, REGULATIONS, AND ORDINANCES, THEY SHALL NOT PROCEED WITH WORK IN QUESTION, EXCEPT AT THEIR OWN RISK, UNTIL ARCHITECT HAS BEEN NOTIFIED IN WRITING AND WRITTEN DETERMINATION IS MADE BY THE ARCHITECT. WHERE COMPLETED OR PARTIALLY COMPLETED WORK IS DISCOVERED TO BE IN VIOLATION WITH APPLICABLE LAWS, CODES REGULATIONS AND ORDINANCES, CONTRACTOR SHALL BE REQUIRED TO REMOVE THAT WORK FROM THE PROJECT AND REPLACE SUCH WORK WITH ALL NEW COMPLYING WORK AT NO ADDITIONAL COST TO THE OWNER OR ARCHITECT.
21. ALL WORK SHALL BE PERFORMED IN AN INDUSTRY STANDARD WORKMANSHIP MANNER.
22. CONTRACTOR RESPONSIBLE FOR ALL MEANS AND METHODS OF CONSTRUCTION.
23. DIMENSIONS OF (E) ELEMENTS TO FACE OF FINISH, DIMENSIONS TO (N) ELEMENTS TO FACE OF FRAMING UNLESS NOTED OTHERWISE.

BUILDING AND CODE INFORMATION

PROJECT DESCRIPTION
GOLF CLUB TERRACE: NEW ELECTRICAL BUILDING
SOUTH WELCHES: NEW ROOF ON (E) ELECTRICAL BUILDING

CODE APPLICABILITY
2022 OREGON STRUCTURAL SPECIALTY CODE (OSSC)
2021 OREGON ZERO ENERGY READY COMMERCIAL CODE (OZERCC)

HEIGHTS AND AREAS
PER OSSC TABLE 503, FOR F-1 OCCUPANCY, TYPE V-B CONSTRUCTION, 8,500 SF, 1-STORY ALLOWED

TYPE OF CONSTRUCTION
V-B

FIRE PROTECTION
NOT REQUIRED IN F-1 OCCUPANCIES

THERMAL ENVELOPE REQUIREMENTS
ENERGY CODE THERMAL ENVELOPE NOT REQUIRED ON (E) SOUTH WELCHES TYPE F OCCUPANCY.

ENERGY CODE THERMAL ENVELOPE COMPLIANCE ON GOLF CLUB TERRACE VIA COM-CHECK ANALYSIS SUBMITTED UNDER SEPARATE COVER.

ROOF: R-30 ATTIC INSULATION

WALLS: R-13 INSULATION

DOORS: U 0.37 MAX

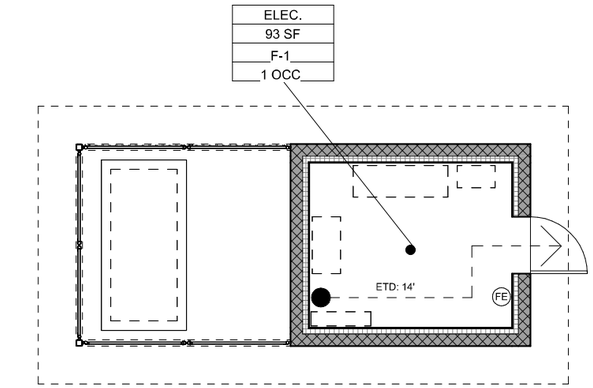
AMERICAN'S WITH DISABILITIES ACT (ADA)
BUILDING IS EXEMPT FROM ADA ACCESSABILITY REQUIREMENTS PER OSSC 1103.2.9 "EQUIPMENT SPACES"

LEGEND

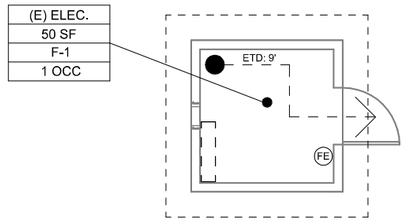
ROOM TAG
NAME — ROOM NAME
150 SF — AREA
OC — OCCUPANCY CATEGORY
XX OCC — NUMBER OF OCCUPANTS

ETD: XX' — EXIT EGRESS ROUTE, ETD = EXIT TRAVEL DISTANCE

FE — FIRE EXTINGUISHER



1 CODE PLAN - GOLF CLUB TERRACE
SCALE: 1/4" = 1'-0"



2 CODE PLAN - SOUTH WELCHES
SCALE: 1/4" = 1'-0"

NO.	DATE	REVISION	BY
1			

DESIGNED: MD
DRAWN: DH
CHECKED: MD
APPROVED: AA

SHEET 3-G7
7 of 184

REGISTERED ARCHITECT — ALAN P. ARMSTRONG — PORTLAND, OREGON — STATE OF OREGON

SCALE: VERT: AS SHOWN; HORIZ:AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

ARCHITECTURAL GENERAL NOTES, LEGEND AND ABBREVIATIONS

mwa architects

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: May 2025

C:\Users\human\Strongwork Dropbox_ACTIVE PROJECTS_21001_WES Pump Stations Upgrade\WES Group III\Design Information\21001_WES PS_R23.rvt

J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Group 3 Final Drawings R2 1901-0206.dwg 3-G8 5/6/2025 2:11 PM SAMRICHMANN 24.2s (LMS Tech)

GENERAL STRUCTURAL NOTES:

1. THESE NOTES ARE GENERAL IN NATURE AND ARE INTENDED TO SET MINIMUM STANDARDS FOR CONSTRUCTION. THE CONTRACTOR SHALL BE COMPLETELY FAMILIAR WITH THE CONTRACT DOCUMENTS AND HAVE A COPY OF THEM ON SITE AT ALL TIMES.
2. FOR ANY PORTION OF THE CONSTRUCTION WHICH THE CONTRACTOR IS UNABLE TO ASCERTAIN THE REQUIRED CONSTRUCTION OR WHERE CONFLICTS EXIST, IT IS THE CONTRACTOR'S RESPONSIBILITY TO REQUEST ADDITIONAL INFORMATION (RFIs) AND/OR CLARIFICATIONS BEFORE CONSTRUCTION.
3. ALL WORK SHALL BE IN STRICT CONFORMANCE WITH THE 2021 INTERNATIONAL BUILDING CODE (IBC) AS AMENDED BY THE 2022 OREGON STRUCTURAL SPECIALTY CODE (OSSC).
4. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND ELEVATIONS BEFORE CONSTRUCTION. THE ARCHITECT AND ENGINEER SHALL BE NOTIFIED OF ANY DISCREPANCIES OR INCONSISTENCIES.
5. THE CONTRACTOR, SUBCONTRACTORS AND SUPPLIERS SHALL ENSURE COORDINATION OF CONTRACTOR SUPPLIED/DESIGNED ELEMENTS AND DEFERRED SUBMITTALS WITH ALL DESIGN DISCIPLINES WITHIN THE CONSTRUCTION SET. COORDINATION SHALL IDENTIFY AND RECONCILE CONFLICTS BETWEEN THE CONTRACTOR SUPPLIED/DESIGNED ELEMENTS AND THE CONSTRUCTION DRAWINGS PRIOR TO FABRICATION AND DELIVERY TO THE PROJECT SITE. THE PROJECT ENGINEER SHALL BE NOTIFIED IF CONFLICTS EXIST.
6. THE CONTRACT STRUCTURAL DRAWINGS REPRESENT THE FINISHED STRUCTURE. METHODS, PROCEDURES, AND SEQUENCE OF CONSTRUCTION ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO MAINTAIN AND ENSURE THE INTEGRITY OF THE STRUCTURE AT ALL STAGES OF CONSTRUCTION.
7. CONSTRUCTION LOADS SHALL NOT EXCEED THE DESIGN LIVE LOAD FOR THE STRUCTURE. PROVIDE SHORING AND/OR BRACING WHERE LOADS EXCEED DESIGN CAPACITY AND WHERE STRUCTURES HAVE NOT ATTAINED DESIGN STRENGTH.
8. CLADDING, WATERPROOFING, AND ARCHITECTURAL FEATURES ARE OUTSIDE THE STRUCTURAL SCOPE OF WORK. ANY DEPICTION OF SUCH FEATURES ON THE STRUCTURAL DRAWINGS ARE NOT INTENDED TO BE USED FOR CONSTRUCTION. REPRESENTATION OF SUCH FEATURES ON THESE DRAWINGS MAY OR MAY NOT BE ACCURATE. REFER TO ARCHITECTURAL DRAWINGS AND/OR SPECIFICATIONS.

DESIGN LOADS: PER 2021 IBC & 2022 OSSC

1603.1.1 - FLOOR LOADS:
- LIVE LOAD ..... 250 PSF

1603.1.2 - ROOF LOADS:
- DEAD LOAD ..... 15 PSF
- LIVE LOAD ..... 20 PSF

1603.1.3 - SNOW LOADS:
- GROUND SNOW LOAD, Pg ..... 65 PSF
- FLAT ROOF SNOW LOAD, Pf ..... 65 PSF
- OREGON MINIMUM SNOW LOAD ..... 25 PSF (2022 OSSC)
- DESIGN SNOW LOAD ..... 77 PSF
- SNOW EXPOSURE FACTOR, Ce 1.0
- SNOW LOAD IMPORTANCE FACTOR, Is 1.10
- THERMAL FACTOR, Ct 1.2

1603.1.4 - WIND DESIGN CRITERIA:
- ULTIMATE DESIGN WIND SPEED, Vult ..... 130 MPH
- RISK CATEGORY IV
- WIND EXPOSURE ..... EXPOSURE B
- INTERNAL PRESSURE COEFFICIENT ..... SIMPLIFIED METHOD PER ASCE CHAPTER 28
- COMPONENTS & CLADDING: DESIGN WIND PRESSURES (+/-)
  - WALL ELEMENTS (Atrib = 10ft^2) ..... 24.93/-33.37 PSF
  - OVERHANG ELEMENTS (Atrib = 10ft^2) ..... NA/-88.07 PSF
  - ROOF ELEMENTS (Atrib = 10ft^2) ..... 15.09/-72.98 PSF

1603.1.5 - EARTHQUAKE DESIGN CRITERIA:
- RISK CATEGORY III
- SEISMIC IMPORTANCE FACTOR, I_E 1.25
- SPECTRAL ACCELERATION, S_S ..... 0.687 g
- SPECTRAL ACCELERATION, S_1 ..... 0.295 g
- SOIL SITE CLASS ..... D (DEFAULT)
- SPECTRAL RESPONSE COEFFICIENT, S_{DS} ..... 0.573 g
- SPECTRAL RESPONSE COEFFICIENT, S_{D1} ..... 0.593 g
- SEISMIC DESIGN CATEGORY ..... CATEGORY D
- SEISMIC FORCE RESISTING SYSTEM(S) ..... SPECIAL REINFORCED MASONRY SHEAR WALLS
- RESPONSE MODIFICATION FACTORS, R ..... R = 5.0
- SEISMIC RESPONSE COEFFICIENTS, C_S 0.143
- SEISMIC FORCE RESISTING SYSTEM(S) ..... STEEL ORDINARY CANTILEVER COLUMNS
- RESPONSE MODIFICATION FACTORS, R ..... R = 1.25
- SEISMIC RESPONSE COEFFICIENTS, C_S 0.573
- ANALYSIS PROCEDURE ..... EQUIVALENT LATERAL FORCE PROCEDURE, PER ASCE-7

FOUNDATIONS:

1. SOIL CHARACTERISTICS HAVE BEEN ASSUMED PER THE 2021 IBC AS AMENDED BY THE 2022 OSSC SECTION 1806 PRESUMPTIVE LOAD-BEARING VALUES OF SOILS CONSISTENT WITH SAND, SILTY SAND, CLAYEY SAND, SILTY GRAVEL AND CLAYEY GRAVEL (SW, SP, SM, SC, GM AND GC) SOIL TYPES. THE CONTRACTOR SHALL VERIFY THE PRESUMED SOIL TYPES PRIOR TO CONSTRUCTION AND NOTIFY THE ENGINEER AND ARCHITECT OF NON-CONFORMING IN-SITU CONDITIONS IF PRESENT BEFORE PROCEEDING.
2. ALL FOUNDATIONS TO BEAR ON UNDISTURBED NATIVE MATERIAL, OR GRANULAR COMPACTED FILL.
3. SOIL DESIGN CRITERIA, PER 2021 IBC SECTION 1806:
   - 3.1. SOIL BEARING - 1,500 PSF
   - 3.2. ⅓ INCREASE ALLOWED FOR SHORT TERM LOADS
   - 3.3. SOIL PROFILE - D
   - 3.4. FRICTION COEFFICIENT - 0.35
   - 3.5. EMBEDDED POLES, PASSIVE - 150 PCF

JOB SITE CONDITIONS AND SAFETY:

1. CONTRACTOR AGREES THAT THEY SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE ENGINEER AND IT'S REPRESENTATIVE HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE ENGINEER.

CONCRETE:

1. ALL CONCRETE SHALL BE HARD ROCK CONCRETE MEETING REQUIREMENTS OF ACI-301, "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS". MIX PROPORTIONS SHALL BE PER ACI-301, METHOD 2 OR THE ALTERNATE PROCEDURE. SUBMIT MIX DESIGN FOR REVIEW BY STRUCTURAL ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.
2. STRUCTURAL CONCRETE SHALL ATTAIN THE FOLLOWING MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS:

MINIMUM COMPRESSIVE STRENGTH	4,500 PSI
% AIR ENTRAINMENT (±1%)	6%
MAXIMUM WATER CONTENT (GALLON PER 94LB. SACK OF CEMENT)	4.5 GALLONS
MIN. CEMENT CONTENT (94LB. SACK OF CEMENT PER CUBIC YARD OF SOLID CONCRETE)	6.5 SACKS
NOMINAL AGGREGATE SIZE	3/4"
INSTALLATION LOCATION(S)	SLABS AND FOOTINGS

3. ALL CONCRETE EXPOSED TO WEATHER SHALL CONTAIN 6% (±) 1% AIR ENTRAINMENT BY VOLUME. AIR ENTRAINMENT SHALL BE IN CONFORMANCE WITH ASTM C260.
4. COLD WEATHER PLACEMENT SHALL CONFORM TO ACI-306. HOT WEATHER PLACEMENT SHALL CONFORM TO ACI-305. MECHANICALLY VIBRATE ALL FORMED CONCRETE. DO NOT OVER-VIBRATE. PLACE CONCRETE MONOLITHICALLY BETWEEN CONSTRUCTION OR CONTROL JOINTS. PROTECT ALL CONCRETE FROM PREMATURE DRYING.
5. CHAMFER ALL EXTERIOR CORNERS 1/2" UNLESS SHOWN OTHERWISE.
6. SLUMP LIMITS MAY BE INCREASED BY ADDITION OF ADMIXTURES PROVIDED THAT THE WATER/CEMENT RATIO OF THE ORIGINAL MIX DESIGN IS NOT EXCEEDED. WATER REDUCING ADMIXTURE SHALL BE IN CONFORMANCE WITH ASTM494, USED IN CONFORMANCE WITH MANUFACTURER'S INSTRUCTIONS. SUBMIT ADMIXTURES TO ENGINEER FOR REVIEW PRIOR TO CONSTRUCTION.
7. CEMENT SHALL BE TYPE I OR II IN CONFORMANCE WITH ASTM C150. AGGREGATES SHALL BE IN CONFORMANCE WITH ASTM C33 AND USE CRUSHED (NOT ROUND) GRAVEL OR STONE. COARSE AGGREGATES SHALL NOT EXCEED 3/4". WATER SHALL BE CLEAN AND POTABLE.
8. REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60. GRADE 40 MAY BE USED FOR #3 AND SMALLER TIES AND STIRRUPS. DETAIL AND PLACE ACCORDING TO ACI MANUAL SP-66. BENDING OF REINFORCING STEEL IN THE FIELD IS NOT PERMITTED WITHOUT APPROVAL BY EOR. REBENDING OR STRAIGHTENING OF REINFORCING OR BENDING OF REINFORCING STEEL CAST INTO CONCRETE IS NOT ALLOWED.
9. UNLESS OTHERWISE NOTED, MINIMUM COVER SHALL BE 1 1/2" FOR #5 AND SMALLER BARS, 2" FOR #6 AND LARGER BARS AND 3" WHEN POURED AGAINST EARTH. SUPPORT REINFORCEMENT WITH APPROVED CHAIRS, SPACERS, OR TIES.
10. PROVIDE MINIMUM 48 BAR DIAMETERS AT SPLICES. NO MORE THAN 50% OF REINFORCING SHALL BE SPLICED AT ANY LOCATION. UNLESS OTHERWISE NOTED, BEND ALL HORIZONTAL REINFORCING A MINIMUM OF 2'-0" AT CORNERS AND WALL/FOOTING INTERSECTIONS WITH MIN. EMBEDMENT BEYOND INTERFACE PER DEVELOPMENT LENGTH SPECIFIED IN ACI 318.
11. FORMWORK SHALL BE IN ACCORDANCE WITH ACI-347 "GUIDE TO FORMWORK FOR CONCRETE". FORMS SHALL BE DESIGNED BY THE CONTRACTOR. BRACING SHALL BE PROVIDED AS REQUIRED OR UNTIL THE CONCRETE HAS REACHED ITS SPECIFIED 28-DAY STRENGTH. ALL SHORING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. FORMWORK, SUPPORTS, AND SHORING SHALL PROVIDE FINISHED CONCRETE SURFACES AT ALL FACES: LEVEL, PLUMB, AND TRUE TO DIMENSIONS AND ELEVATIONS SHOWN IN THE DRAWINGS.

CONCRETE MASONRY (CMU):

1. CONCRETE MASONRY UNITS SHALL BE MEDIUM WEIGHT UNITS CONFORMING TO ASTM C90. THEY SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2,000 PSI. CONTRACTOR TO VERIFY PER UNIT STRENGTH METHOD.
2. MORTAR SHALL BE TYPE M OR S WITH A MINIMUM COMPRESSIVE STRENGTH OF 1,800 PSI.
3. GROUT SHALL CONFORM TO ASTM C476 AND SHALL BE EQUAL TO 2,500 PSI MIN.
4. FOR GROUT LIFTS EXCEEDING FIVE (5) FEET, CLEAN OUTS SHALL BE PROVIDED AT THE BOTTOM OF EACH CELL AND AT NO MORE THAN 32" APART. GROUT SHALL BE INSTALLED IN ALL CELLS CONTAINING (E.G. SOLID GROUTING).
5. UNIT STRENGTH METHOD SHALL BE USED TO VERIFY MINIMUM COMPRESSIVE STRENGTH OF MASONRY f'_m = 2,000 PSI.
6. MASONRY SHALL BE LAID IN RUNNING BOND.

STRUCTURAL STEEL:

1. STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING GRADES, UNLESS NOTED OTHERWISE ON THE PLANS:

SHAPE	ASTM DESIGNATION	YIELD STRESS (Fy)
PLATES & BARS	ASTM A36	36 ksi
HSS (RECTANGULAR)	ASTM A500, GRADE C	50 ksi
CHANNELS & ANGLES	ASTM A36	36 ksi

2. WELD ACCORDING TO CURRENT AWS STANDARDS WITH E70XX ELECTRODES.
3. WELD SIZES SHOWN ON THE DESIGN DRAWINGS ARE CONSIDERED EFFECTIVE WELD SIZES AND SHALL BE INCREASED IN ACCORDANCE WITH AWS AS REQUIRED BY GAPS OR SKEWS BETWEEN COMPONENTS.
4. ALL STEEL EXPOSED TO WEATHER SHALL BE PAINTED OR HOT-DIP GALVANIZED, UNLESS NOTED OTHERWISE.
5. ALL STRUCTURAL CONNECTION BOLTS SHALL BE ASTM F3125 GRADE A325, UNLESS NOTED OTHERWISE. HOOKED, HEADED, THREADED, AND NUTTED ANCHOR RODS SHALL BE ASTM F1554 (Fy = 55 ksi), UNLESS NOTED OTHERWISE.
6. CONTACT BETWEEN DISSIMILAR METALS SHALL BE ISOLATED USING PHENOLIC OR OTHERWISE APPROVED ISOLATION HARDWARE

POST–INSTALLED CONCRETE ANCHORS:

1. ADHESIVE:
   - 1.1. ADHESIVE ANCHORS SHALL BE INSTALLED BY QUALIFIED PERSONNEL TRAINED TO INSTALL ADHESIVE ANCHORS IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND WITH STRICT ADHERENCE TO THE PROVISIONS WITHIN THE MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS.
   - 1.2. AT THE TIME OF ANCHOR INSTALLATION, IN ACCORDANCE WITH ACI 318-14 SECTION 17.1.2, ADHESIVE ANCHORS SHALL BE INSTALLED IN CONCRETE HAVING A MINIMUM AGE OF 21 DAYS.
   - 1.3. WHERE THE AUTHORITY HAVING JURISDICTION OVER THIS PROJECT REQUIRES ADHERENCE TO ACI 318-14 SECTION 17.8.2.2, INSTALLATION OF ADHESIVE ANCHORS IN HORIZONTAL TO VERTICALLY OVERHEAD ORIENTATION SHALL BE DONE BY A CERTIFIED ADHESIVE ANCHOR INSTALLER (AAI) AS CERTIFIED THROUGH ACI AND IN ACCORDANCE WITH ACI 318-14 SECTION 17.8.2.2. PROOF OF CURRENT CERTIFICATION SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO COMMENCEMENT OF INSTALLATION. NOTE: THE STATE OF OREGON DOES NOT REQUIRE ADHERENCE TO ACI 318-14 SECTION 17.8.2.2.
2. MECHANICAL:
   - 2.1. MECHANICAL ANCHORS SHALL BE INSTALLED BY QUALIFIED PERSONNEL TRAINED TO INSTALL MECHANICAL ANCHORS IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND WITH STRICT ADHERENCE TO THE PROVISIONS WITHIN THE MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS.

METAL STUD FRAMING:

1. ALL PRODUCTS SHALL BE MANUFACTURED BY THE CURRENT MEMBERS OF THE STEEL STUD MANUFACTURERS ASSOCIATION
2. ALL GALVANIZED STUDS AND JOISTS SHALL BE FORMED FROM STEEL THAT CORRESPONDS TO THE MINIMUM REQUIREMENTS OF THE CURRENT A.I.S.I. STANDARDS
3. ALL STRUCTURAL MEMBERS SHALL BE DESIGNED IN ACCORDANCE WITH THE AMERICAN IRON AND STEEL INSTITUTE (AISI) "SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS, CURRENT EDITION.
4. PROVIDE ALL ACCESSORIES INCLUDING, BUT NOT LIMITED TO, TRACKS, CLIPS, WEB STIFFENERS, ANCHORS, FASTENING DEVICES, RESILIENT CLIPS, AND OTHER ACCESSORIES REQUIRED FOR A COMPLETE AND PROPER INSTALLATION, AND AS RECOMMENDED BY THE MANUFACTURER FOR THE STEEL MEMBERS USED.
5. FASTENING OF COMPONENTS SHALL BE WITH SELF-DRILLING SCREWS OR WELDING. SCREWS OR WELDS SHALL BE OF SUFFICIENT SIZE TO ENSURE THE STRENGTH OF THE CONNECTION. ALL WELDS OF GALVANIZED STEEL SHALL BE TOUCHED UP WITH A ZINC-RICH PAINT. ALL WELDS OF CARBON SHEET STEEL SHALL BE TOUCHED UP WITH PAINT. WIRE TYING OF COMPONENTS SHALL NOT BE PERMITTED.

SOLID SAWN LUMBER:

1. STRUCTURAL LUMBER SHALL BE DOUGLAS FIR CONFORMING TO WWPA GRADING RULES.
2. MINIMUM GRADE IS TO BE #2, EXCEPT AS NOTED OTHERWISE.
3. NOTCHING IS NOT PERMITTED IN JOISTS, RAFTERS, BEAMS, LINTELS, COLUMNS, TRUSSES, AND BRACING MEMBERS.
4. PRESSURE TREATED LUMBER SHALL CONFORM TO THE AWPA AND SHALL BEAR THE QUALITY MARK OF AN ACCREDITED ALSC INSPECTION AGENCY. MINIMUM TREATING STANDARDS (RETENTION LBS./CU. FT) SHALL BE AS FOLLOWS:

APPLICATION	ACQ/ACZA	CA-B
ABOVE GROUND	0.25	0.10
GROUND CONTACT	0.40	0.21
FRESH WATER IMMERSION	0.40	0.21
IN GROUND (STRUCTURAL)	0.60	0.31
SILL PLATES	0.25	0.10

5. ALL LUMBER IN CONTACT WITH CONCRETE SHALL BE PRESSURE TREATED WITH ACZA TO A MINIMUM RETENTION OF 0.25 POUNDS PER CUBIC FOOT BY ASSAY.
6. NAILING SHALL BE IN CONFORMANCE WITH THE 2021 IBC AS AMENDED BY THE OSSC UNLESS NOTED OTHERWISE. FASTENERS FOR PRESERVATIVE-TREATED WOOD SHALL BE OF HOT-DIPPED ZINC-COATED GALVANIZED STEEL, STAINLESS STEEL, SILICON BRONZE OR COPPER. THE COATING WEIGHTS FOR ZINC-COATED FASTENERS SHALL BE IN ACCORDANCE WITH ASTM A-153. 5/8-INCH DIAMETER STEEL ANCHOR BOLTS & LARGER NEED NOT BE GALVANIZED, UNLESS NOTED OTHERWISE.
7. PROVIDE STANDARD 3"x3"x¼" PLATE WASHERS UNDER ALL INTERMEDIATE ANCHOR BOLT HEADS AND NUTS AT THE SILL PLATE. USE STANDARD WASHERS FOR ALL OTHER BOLT HEADS AND NUTS IN CONTACT WITH WOOD.

SHEATHING:

1. WOOD STRUCTURAL PANELS SHALL BE APA RATED EXPOSURE 1 PLYWOOD, AND COVERED IN DOC PS 1 AND PS 2, UNLESS NOTED OTHERWISE.
2. MINIMUM PANEL THICKNESS SHALL BE 15/32", OR AS INDICATED IN THESE PLANS. PARTICLEBOARD IS NOT PERMITTED.
3. MINIMUM NAILING IS 8d@6" AT PANEL EDGES AND 8d@12" IN THE FIELD. ALL NAILS SHALL BE COMMON OR GALVANIZED BOX NAILS. BLOCKING IS REQUIRED WHERE NOTED ON THE PLANS.

PREMANUFACTURED CONNECTION HARDWARE:

1. CONNECTION HARDWARE IS BY THE SIMPSON COMPANY OF SAN LEANDRO, CA. ALL STEEL CONNECTORS SHALL BE GALVANIZED OR BY SOME METHOD MADE CORROSION RESISTANT, UNLESS OTHERWISE INDICATED.
2. PROVIDE BOLTED OR NAILED CONNECTIONS FOR THE MAXIMUM CAPACITY UNLESS NOTED OTHERWISE.
3. CONNECTORS IN CONTACT WITH PRESSURE TREATED WOOD SHALL BE EITHER POST HOT-DIP GALVANIZED OR STAINLESS STEEL. FASTENERS SHALL BE OF THE SAME MATERIAL OR PROTECTIVE COATING AS THE CONNECTORS, DO NOT MIX DIFFERING METALS IN THE SAME CONNECTION.
4. ALL HARDWARE SHALL BE INSTALLED PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS, UNLESS NOTED OTHERWISE.

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PSE
PETERSON STRUCTURAL ENGINEERS

NO.	DATE	REVISION	BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3-G8 8 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE
ETHAN DAVID ALTON
OREGON
NOV. 9, 2021
EXPIRES 12/31/25

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

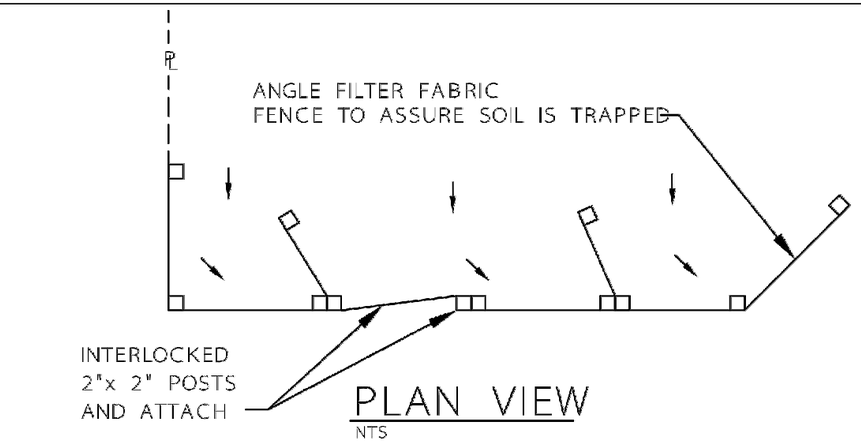
STRUCTURAL GENERAL NOTES

consor

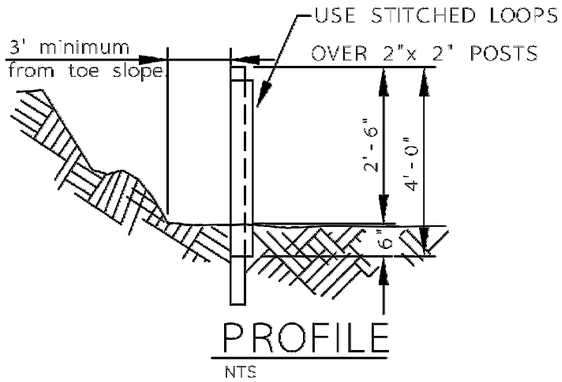
DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES



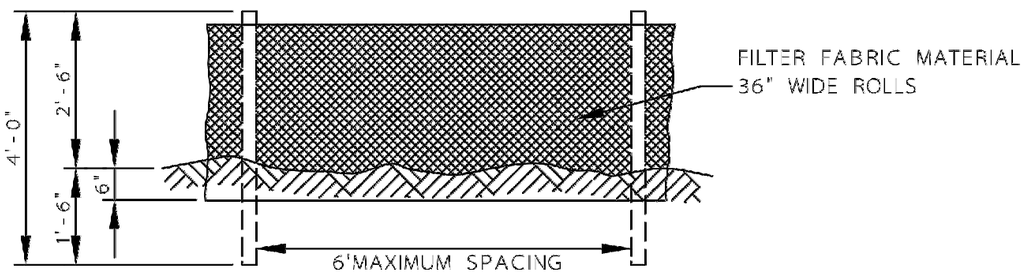
PLAN VIEW
NTS



PROFILE
NTS

NOTES:

1. BURY BOTTOM OF FILTER FABRIC 6" VERTICALLY BELOW FINISHED GRADE.
2. 2"x 2" FIR, PINE OR STEEL FENCE POSTS.
3. POSTS TO BE INSTALLED ON UPHILL SIDE OF SLOPE.
4. COMPACT BOTH SIDES OF FILTER FABRIC TRENCH.
5. PANELS MUST BE PLACED ACCORDING TO SPACING ON DETAIL NO.940

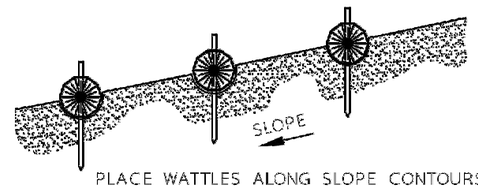


FRONT VIEW
NTS

SEDIMENT FENCE

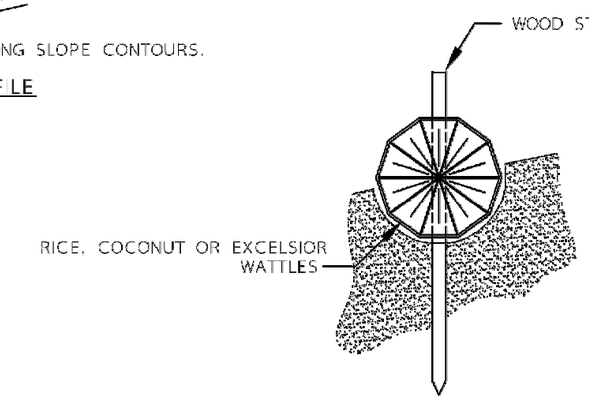
DETAIL DRAWING 4-23

REVISED 01-09

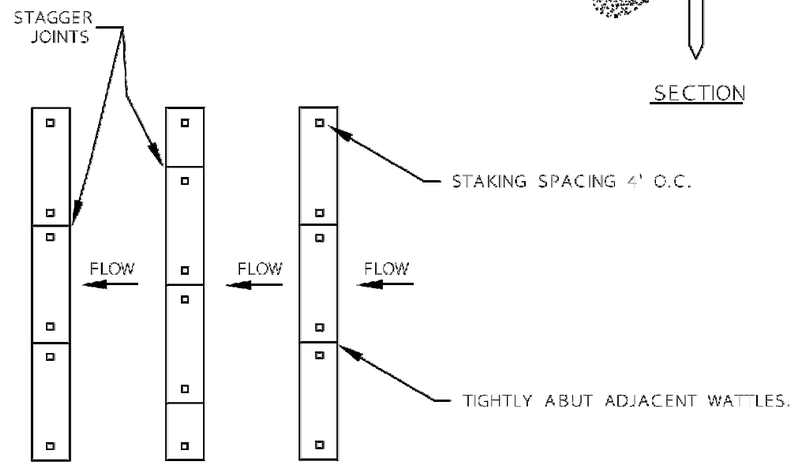


PLACE WATTLES ALONG SLOPE CONTOURS.

PROFILE



SECTION



PLAN VIEW

NOTES:

1. STAKING SPECIFICATIONS:
   a. 1"X2" WOODEN STAKES
   b. ADDITIONAL STAKES MAY BE INSTALLED ON DOWNHILL SIDE OF WATTLES, ON STEEP SLOPE OR HIGHLY EROSIVE SOILS.
2. SPACING IN ACCORDANCE WITH DETAIL 940.

WATTLES

DETAIL DRAWING 4-27

REVISED 01-09

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3-GD1 9 of 184

LICENSED PROFESSIONAL ENGINEER — OREGON — 9812 — Nicholas Laferriere — Date: — RENEWS 12-31-26

LICENSED PROFESSIONAL ENGINEER — OREGON — 98122PE — Nicholas Laferriere — Date: — RENEWS 12-31-26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GENERAL EROSION AND SEDIMENT CONTROL DETAILS - 1

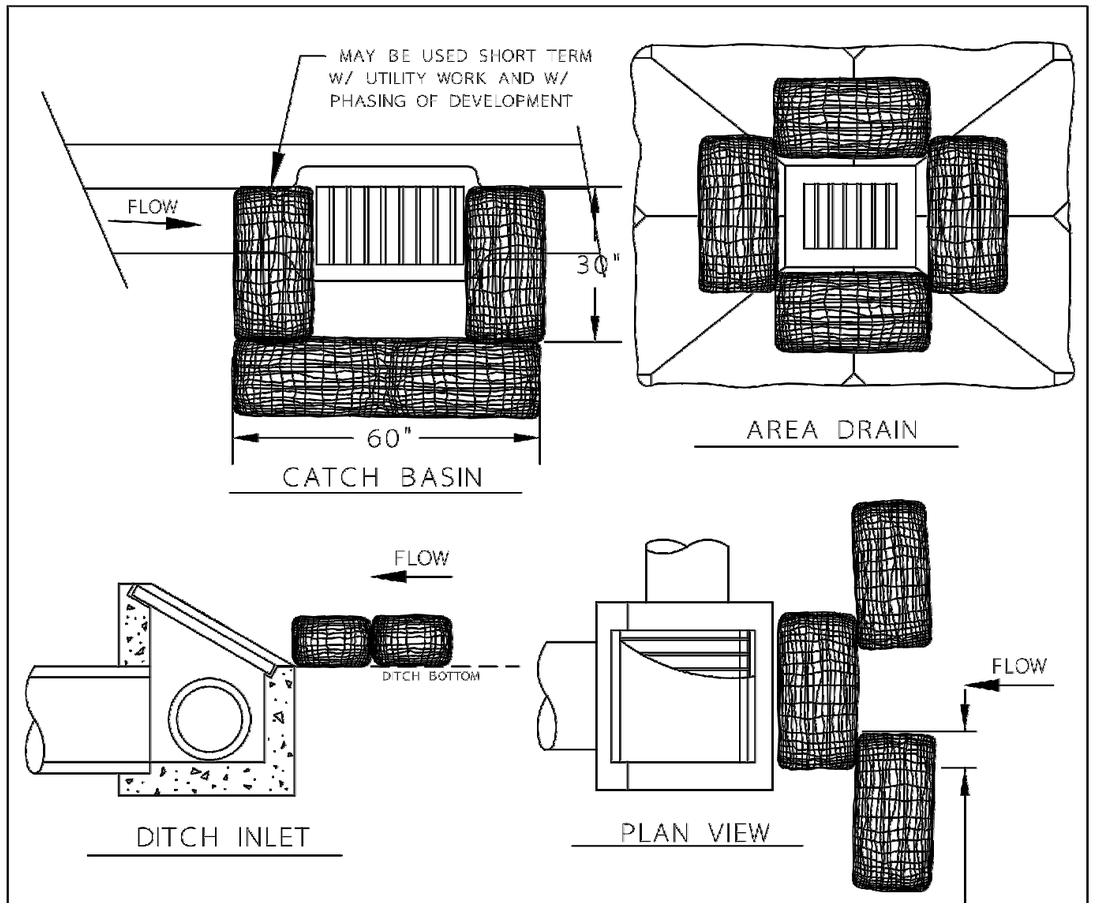
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DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-GD.dwg 3-GD1 4/25/2025 8:08 AM NICK.MCFADDIN 24.1s (LMS Tech)



NOTES:

1. ADDITIONAL MEASURES MUST BE CONSIDERED DEPENDING ON SOIL TYPES.

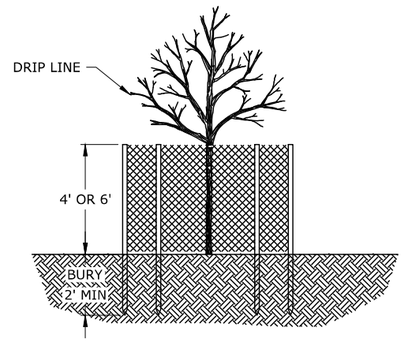
2. BIO-FILTER BAGS SHOULD BE STAKED WHERE APPLICABLE USING (2) 1"x2"WOODEN STAKES OR APPROVED EQUAL PER BAG.

3. WHEN USING 30" BIO-BAGS TO PROTECT A CATCH BASIN YOU MUST HAVE 4 BAGS AND THEY SHALL BE OVERLAPPED BY 6".

INLET PROTECTION TYPE 4

DETAIL DRAWING 4-18

REVISED 01-09



NOTES:

1. ORANGE FENCING SHALL BE 4' IN HEIGHT, MESH CHAIN LINK FENCE SHALL BE 6' IN HEIGHT. FENCE SHALL BE SET AS SHOWN ON THE PLANS.

2. FENCE MATERIALS SHALL CONSIST OF ORANGE CONSTRUCTION FENCING OR MESH CHAIN LINK AS SHOWN ON THE PLANS, SECURED TO A MINIMUM 1 ½" DIAMETER STEEL OR ALUMINUM LINE POSTS.

3. POSTS SHALL BE SET TO A DEPTH OF NO LESS THAN 2 FEET IN NATIVE SOIL.

4. FENCE SHALL REMAIN IN PLACE UNTIL CART PATH PAVING PHASE OF CONSTRUCTION REQUIRES REMOVAL, MOVEMENT OR REMOVAL OF FENCE REQUIRES APPROVAL BY OWNER'S AUTHORIZED REPRESENTATIVE.

TREE PROTECTION FENCING DETAIL

1

SCALE: NTS

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3-GD2 10 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas A. Lafrenz RENEWS 12-31-26

REGISTERED LANDSCAPE ARCHITECT 2008 Nicholas A. Lafrenz RENEWS 12-31-26

Nicholas A. Lafrenz
Date:

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GENERAL EROSION AND SEDIMENT CONTROL DETAILS - 2

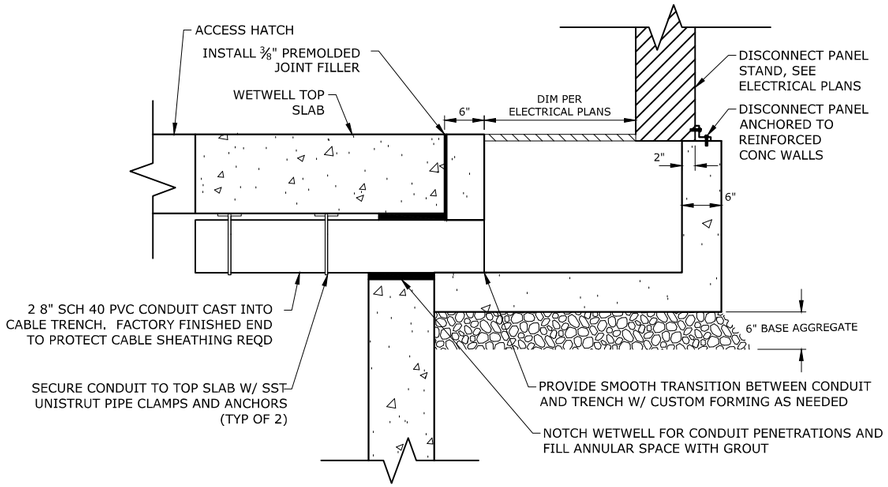
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DATE: MAY 2025

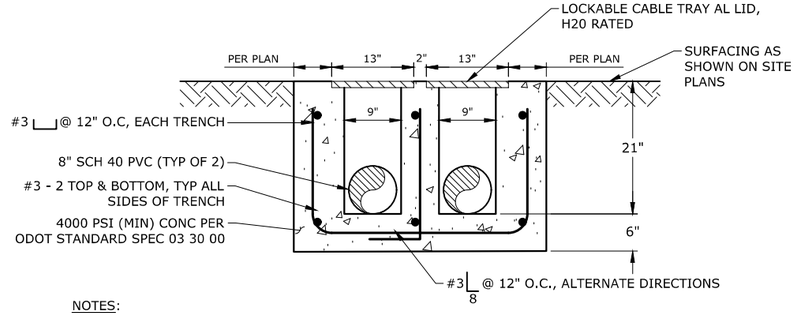
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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ELEVATION



CROSS SECTION

NOTES:

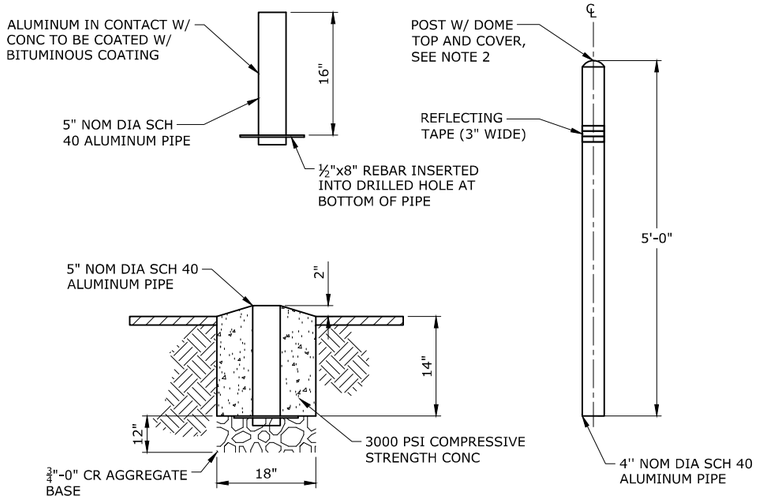
1. THE CABLE TRENCH SHALL BE A COMPLETE PRE-ENGINEERED SYSTEM AS SHOWN.

2. PROVIDE LIGHT BROOM FINISH ON CONCRETE SURFACE, AND SACK FINISH WITHIN TRENCHES.

CABLE TRENCH DETAIL

SCALE: NTS

1
-



NOTES:

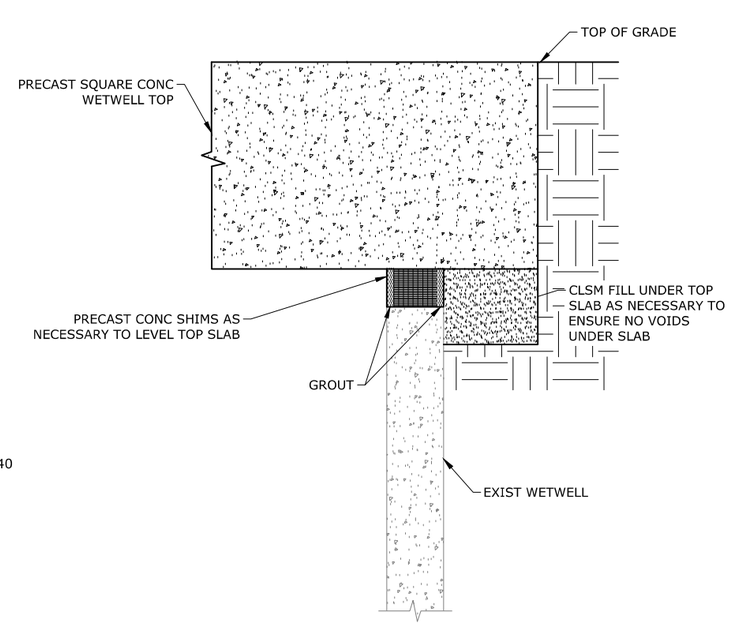
1. GENERAL LOCATION OF BOLLARDS SHOWN ON PLANS. LOCATE BOLLARDS WITH A MINIMUM 3' CLEARANCE FROM ALL UNDERGROUND PIPING AND APPURTENANCES AND A MINIMUM 2' CLEARANCE FROM ALL STRUCTURES. BOLLARD LOCATIONS SHALL BE VERIFIED BY THE OWNER'S REPRESENTATIVE.

2. COVER ALUMINUM PIPE WITH YELLOW ⅛" THICK HIGH DENSITY POLYETHYLENE DOME TOP BOLLARD COVER BY POST GUARD OR APPVD EQ

4" REMOVABLE BOLLARD

SCALE: NTS

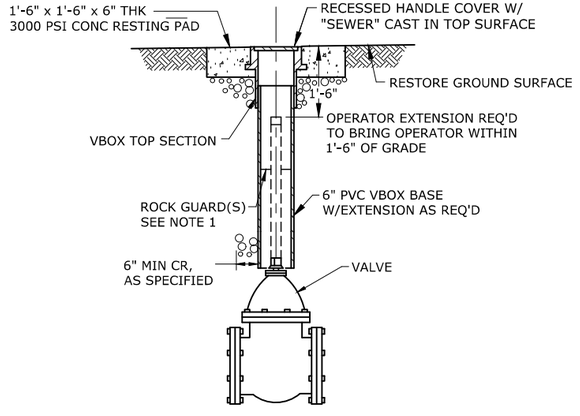
2
-



WETWELL TOP RETROFIT DETAIL

SCALE: NTS

3
-



NOTES:

1. NO ROCK GUARD REQUIRED IF OPERATOR NUT WITHIN 36" OF FINISH GRADE. WHERE DEPTH FROM ROCK GUARD TO OPERATOR NUT IS GREATER THAN 6'-0", INSTALL SECOND ROCK GUARD.

VALVE BOX DETAIL

SCALE: NTS

4
-

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3-GD3 11 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98126PE — Nicholas Scott Laferriz — Date: 12/31/25 — RENEWS 12-31-26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GENERAL CIVIL DETAILS - 1

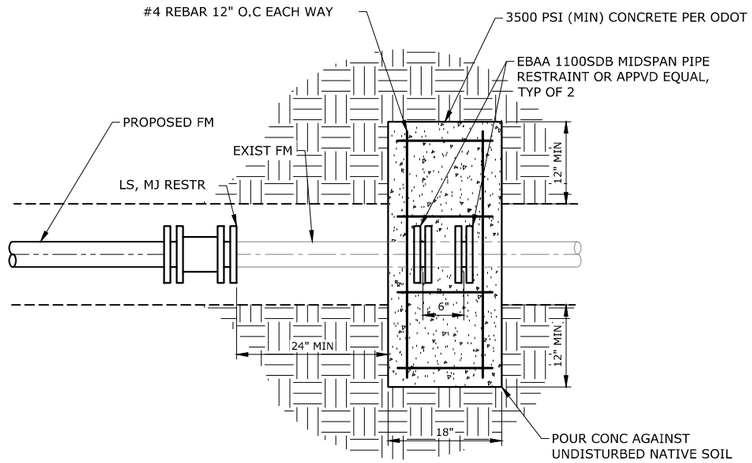
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DATE: MAY 2025

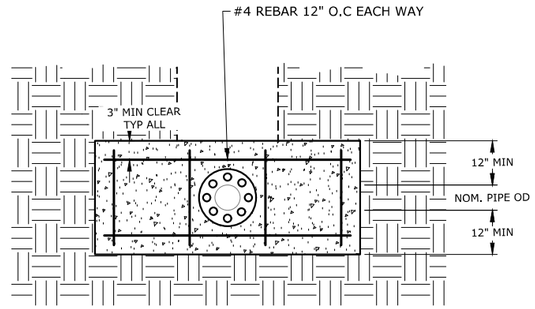
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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PLAN



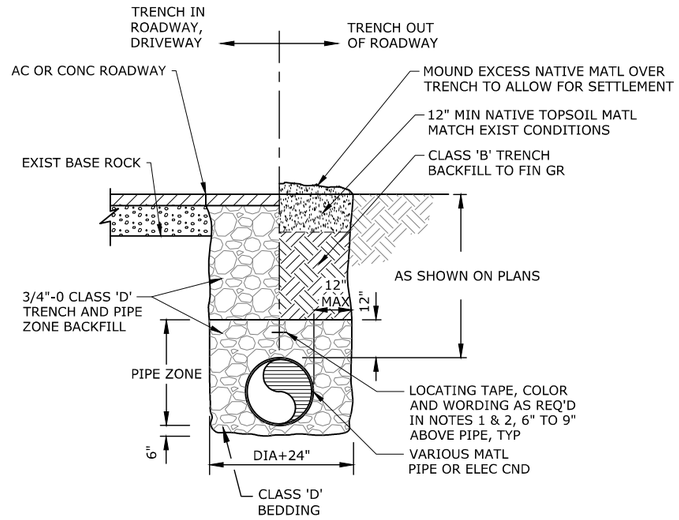
SECTION

NOTES:

1. INSTALL MIDSPAN PIPE RESTRAINTS PER MANUFACTURER'S RECOMMENDATIONS WITH A MIN OF 2" DISTANCE BETWEEN FACE OF EACH RESTRAINT.

2. NO JOINTS BETWEEN END OF LS AND STRADDLE BLOCK.

STRADDLE BLOCK DETAIL 1/-
SCALE: NTS



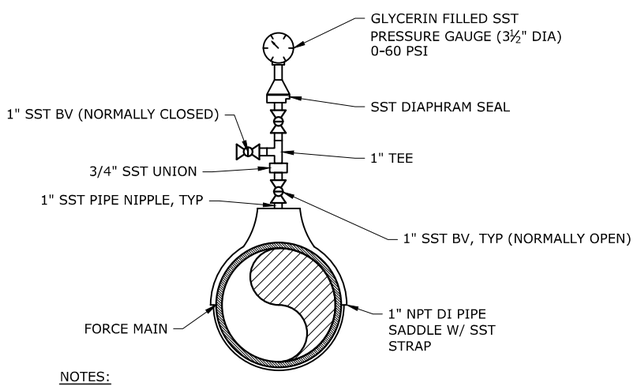
NOTES:

1. ALL NEW UNDERGROUND UTILITIES, REGARDLESS OF SIZE/MATERIAL/USE, RECEIVE LOCATING TAPE, EXCEPT WHERE NOTED OTHERWISE.

2. WORDING ON 4" MIN WIDTH LOCATING TAPE SHALL BE AS FOLLOWS:

SAN FM:	CAUTION BURIED SEWER LINE BELOW
SAN GRAVITY:	CAUTION BURIED SEWER LINE BELOW
PVC STORM:	CAUTION BURIED SEWER LINE BELOW
WATER LINE:	CAUTION BURIED WATER LINE BELOW
ELEC CONDUIT:	CAUTION BURIED ELECTRICAL LINE BELOW

SINGLE PIPE TRENCH DETAIL 2/-
SCALE: NTS

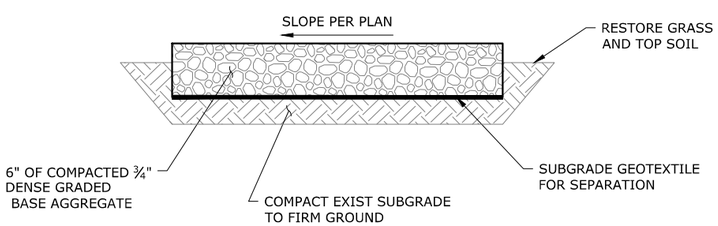


NOTES:

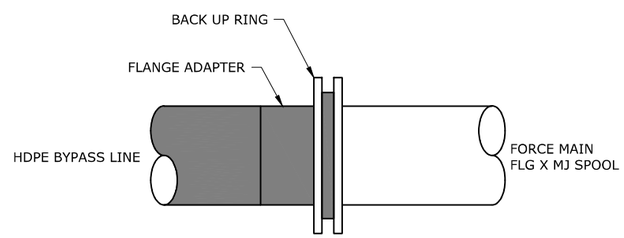
1. ALL PIPE AND FITTINGS SHALL BE SCHEDULE 80 STAINLESS STEEL WITH THREADED ENDS.

2. INSTALL PRESSURE GAUGE AND DIAPHRAGM SEAL PER MANUFACTURERS' REQUIREMENTS.

DISCHARGE LINE PRESSURE GAUGE DETAIL 3/-
SCALE: NTS



PS GRAVEL SURFACING SECTION 4/-
SCALE: NTS



NOTES:

1. PIPE SIZE PER SITE

BYPASS TO FM ADAPTER DETAIL 5/-
SCALE: NTS

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3-GD4 12 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 OREGON Nicholas S. Lafrenz RENEWS 12-31-26

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT OREGON Nicholas S. Lafrenz RENEWS 12-31-26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GENERAL CIVIL DETAILS - 2

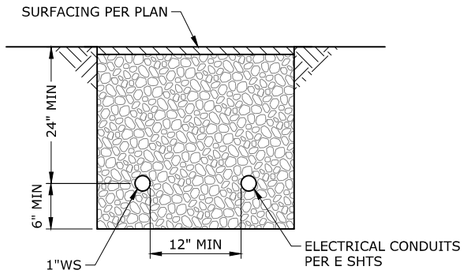
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DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

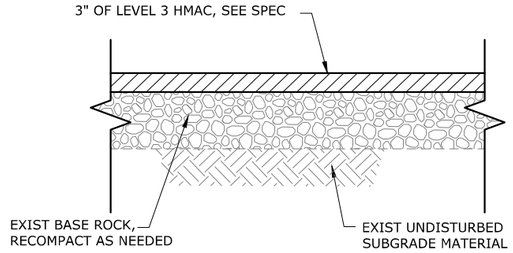
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JOINT WATER AND ELECTRICAL TRENCH

1 / -

SCALE: NTS



TYPICAL AC PAVEMENT SECTION

2 / 3D-C6

SCALE: NTS

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3-GD5 13 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas S. Laferriz OREGON JULY 31, 1981 RENEWS 12-31-26

Nicholas S. Laferriz
Date:

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GENERAL CIVIL DETAILS - 3

CLACKAMAS WATER ENVIRONMENT SERVICES

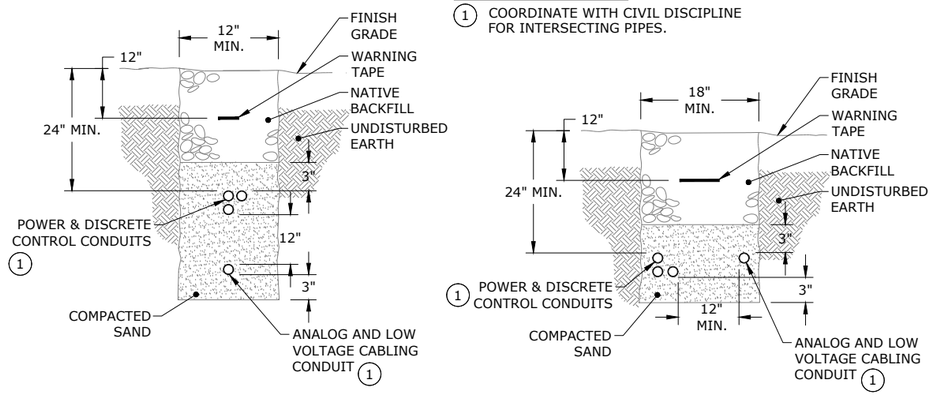
consor

PROJECT: 19-2679 DATE: MAY 2025

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DETAIL NOTES

1. COORDINATE WITH CIVIL DISCIPLINE FOR INTERSECTING PIPES.



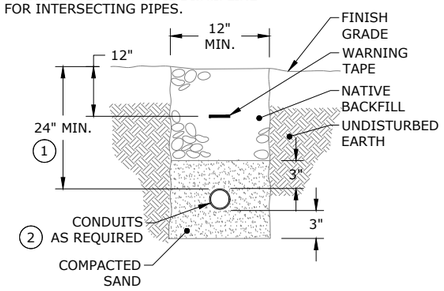
MIXED CONDUIT TRENCHES

SCALE: NONE

1 / -

DETAIL NOTES

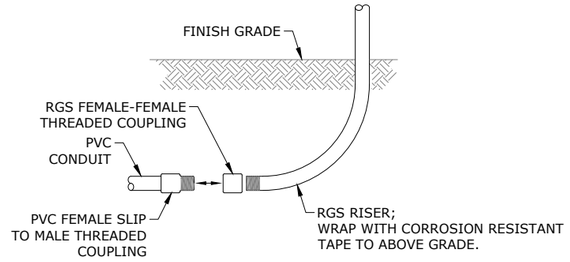
1. VERIFY TRENCH DEPTH AND COVERING FOR INCOMING SERVICE CONDUIT WITH LOCAL UTILITY. TYP MIN OF 3'.
2. COORDINATE WITH CIVIL DISCIPLINE FOR INTERSECTING PIPES.



TYP. CONDUIT TRENCH

SCALE: NONE

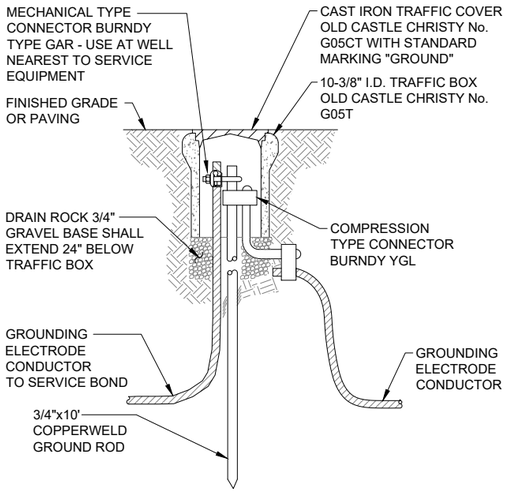
2 / -



CONDUIT TRANSITION

SCALE: NONE

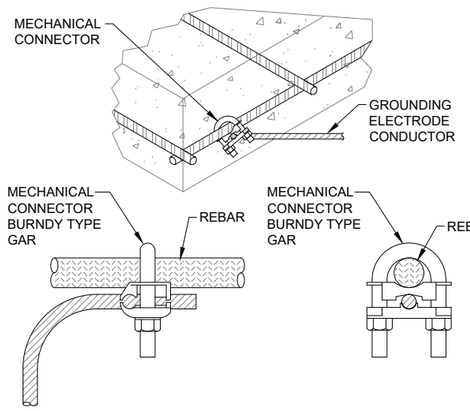
3 / -



GROUND ROD TEST WELL

SCALE: NONE

4 / -



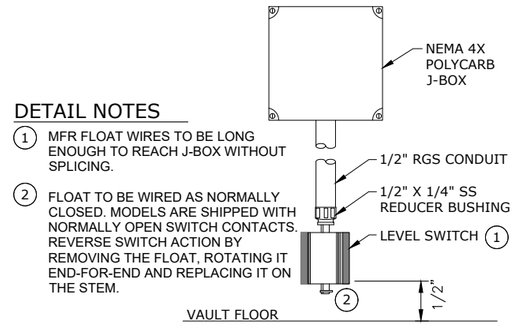
REBAR GROUNDING

SCALE: NONE

5 / -

DETAIL NOTES

1. MFR FLOAT WIRES TO BE LONG ENOUGH TO REACH J-BOX WITHOUT SPLICING.
2. FLOAT TO BE WIRED AS NORMALLY CLOSED. MODELS ARE SHIPPED WITH NORMALLY OPEN SWITCH CONTACTS. REVERSE SWITCH ACTION BY REMOVING THE FLOAT, ROTATING IT END-FOR-END AND REPLACING IT ON THE STEM.



FLOOD SWITCH DETAIL

SCALE: NONE

6 / -

NO.	DATE	REVISION	BY
		DESIGNED: RSC	
		DRAWN: RSC	
		CHECKED: NEW	
		APPROVED: MEW	

SHEET 3-GD6 14 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2009 MICHAEL E. WALLIS EXPIRES: 6/30/26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE 0 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GENERAL ELECTRICAL DETAILS

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: ie@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

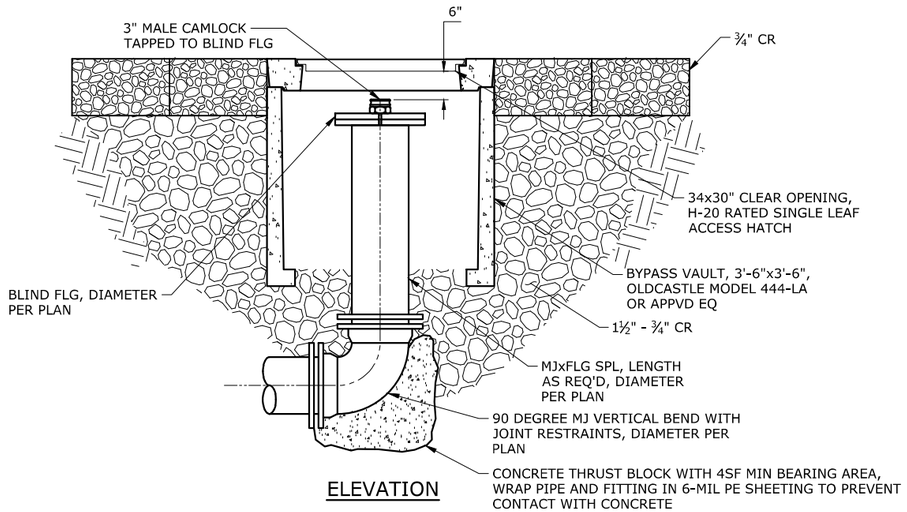
consor

CLACKAMAS WATER ENVIRONMENT SERVICES

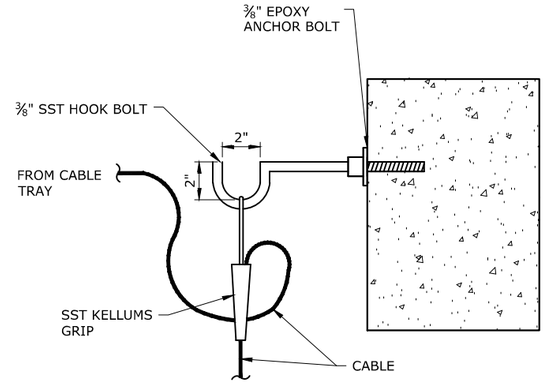
DATE: MAY 2025

PROJECT: 19-2679

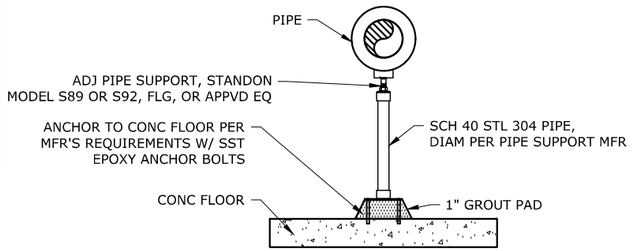
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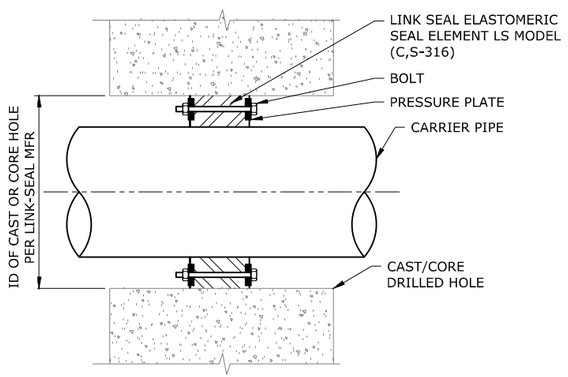
BYPASS ASSEMBLY (1 / -)
SCALE: NTS



TYPE A HANGER CONFIGURATION (2 / -)
SCALE: NTS



FLOOR MOUNTED PIPE SUPPORT (3 / -)
SCALE: 3/4"=1'-0"



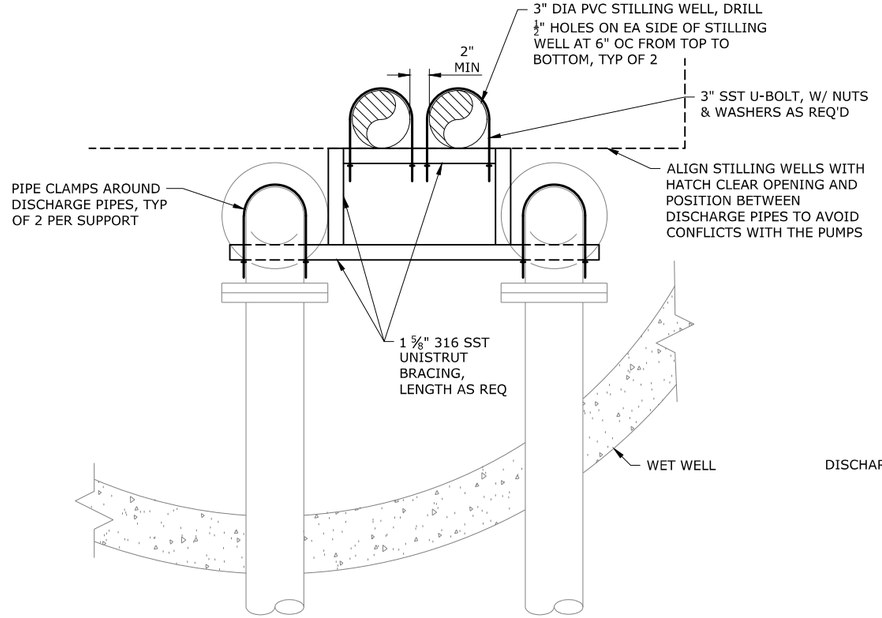
CAST/CORE DRILLED WALL OPENING

NOTES:

1. PROVIDE ONE LINK SEAL AT EACH PENETRATION FOR WALLS SMALLER THAN 6" THICK. FOR WALLS LARGER THAN 6", USE TWO LINK SEALS.

2. IF TWO LINK SEALS ARE NEEDED, EXTERIOR SEAL TO BE INSTALLED SO IT CAN BE TIGHTENED FROM THE INSIDE OF THE STRUCTURE.

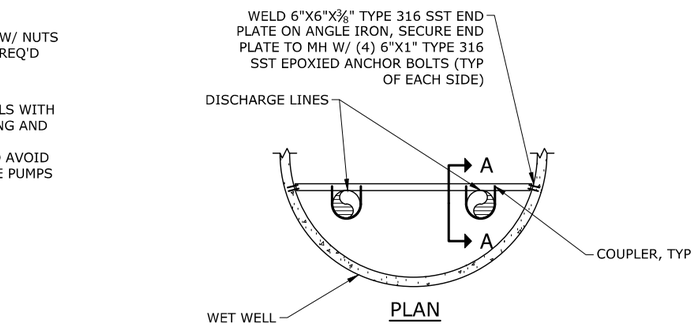
WALL PENETRATION (4 / -)
SCALE: NTS



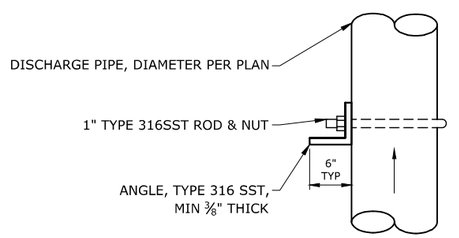
NOTES:

1. INSTALL SUPPORTS EVERY 5', MINIMUM TWO SUPPORTS TOTAL

STILLING WELL SUPPORT DETAIL (5 / -)
SCALE: NTS



PLAN



SECTION A-A

DISCHARGE PIPE SUPPORT DETAIL (6 / -)
SCALE: NTS

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NO.	DATE	REVISION	BY

SHEET 3-GD7 15 of 184

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

OREGON PROFESSIONAL ENGINEER 98172 Nicholas A. Laferriere RENEWS 12-31-26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GENERAL MECHANICAL DETAILS

consor

DATE: MAY 2025
PROJECT: 19-2679

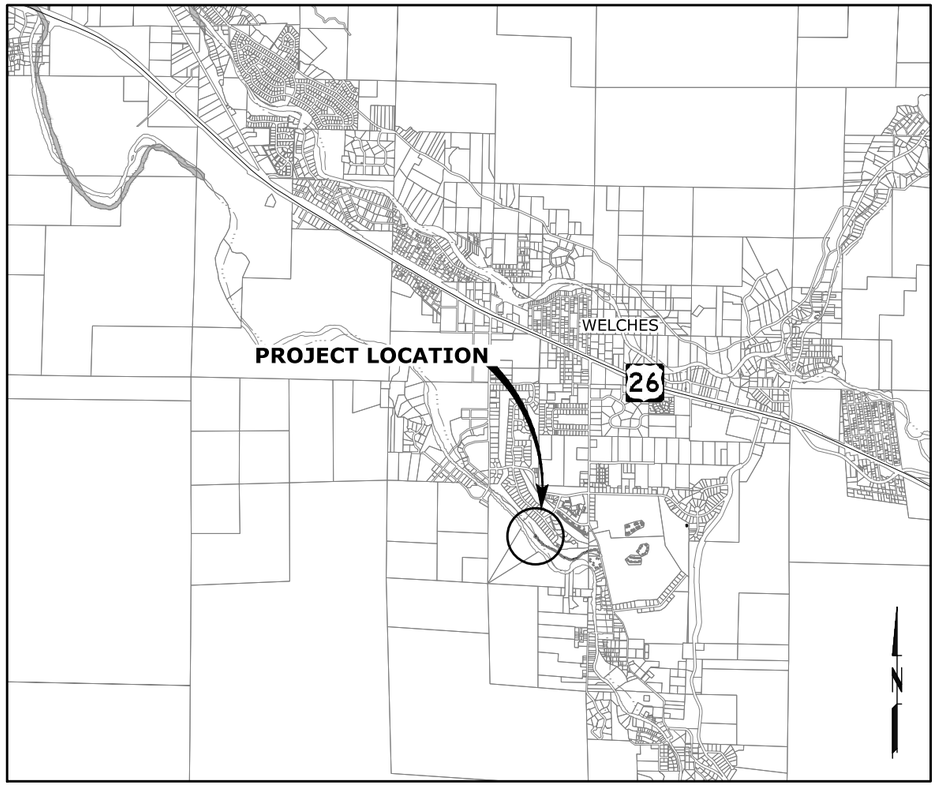
CLACKAMAS WATER ENVIRONMENT SERVICES

CLACKAMAS
WATER ENVIRONMENT SERVICES

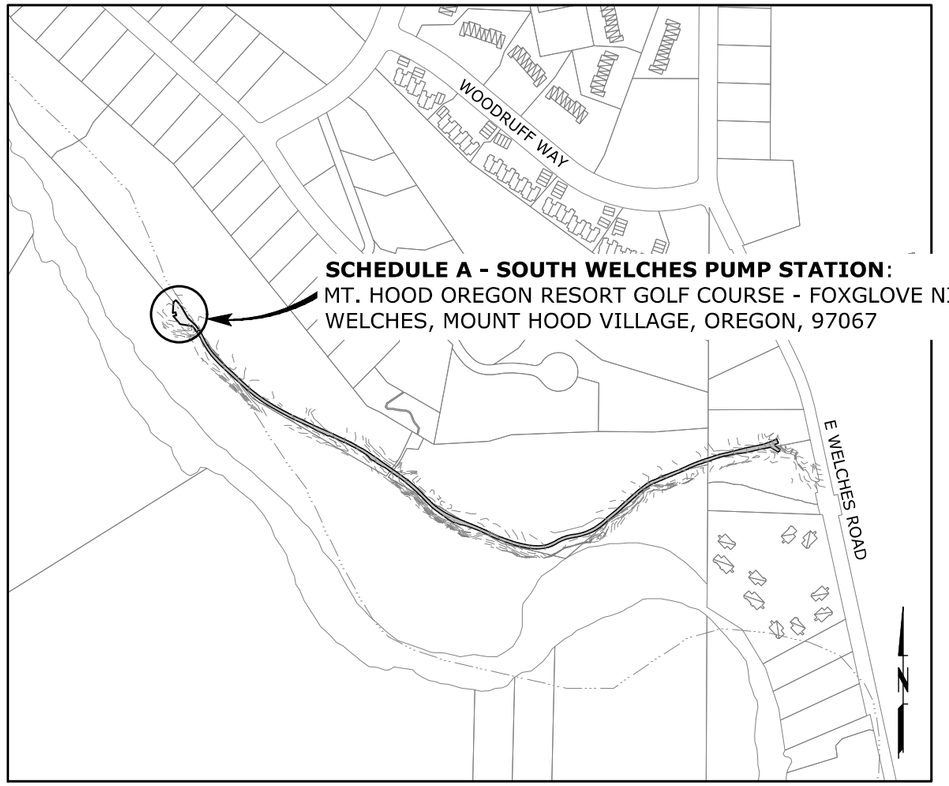
PUMP STATION REHABILITATION AND UPGRADES PROJECT

GROUP 3
SCHEDULE A - SOUTH WELCHES PUMP STATION

AUGUST 2024



VICINITY MAP
SCALE: 1"=2,000'



LOCATION MAP
SCALE: 1"=200'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: JCC
CHECKED: EPK
APPROVED: NSL

SHEET 3A-G1
16 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas S. Lafrenz
RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN
NOTICE 0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
COVER SHEET, LOCATION & VICINITY MAP

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

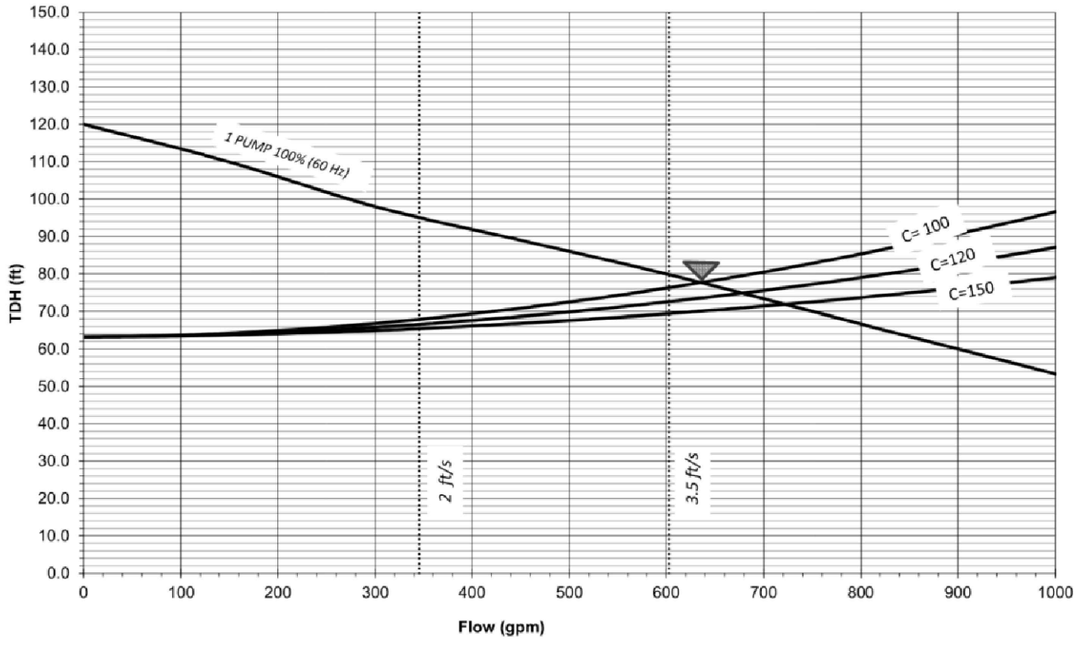
PROJECT: 19-2679
DATE: MAY 2025

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SOUTH WELCHES PUMP STATION AND FORCE MAIN DESIGN DATA TABLE

PUMP STATION	
LOCATION	MT. HOOD OREGON RESORT GOLF COURSE - FOXGLOVE NINE, HOLE 2, WELCHES, MOUNT HOOD VILLAGE, OREGON, 97067
TYPE	DUPLEX SUBMERSIBLE SEWAGE PUMP STATION WITH CONSTANT SPEED PUMPS
RATED CAPACITY (PER PUMP)	MINIMUM 640 GPM AT 76 FT TDH
FIRM CAPACITY OF PUMP STATION	640 GPM AT 76 TDH
MOTOR HORSEPOWER, HP	20 HP
PUMP STARTS AT INFLOW = 50% OF THE PUMP CAPACITY	5.0 PER PUMP PER HOUR
WET WELL OPERATIONAL VOLUME	752 GALLONS (PUMPS OFF TO LEAD PUMP ON)
LEVEL CONTROL TYPE	SUBMERSIBLE LEVEL TRANSDUCER (PRIMARY), HIGH LEVEL FLOAT W/ TIMER SHUT-OFF (BACKUP)
ALARM TELEMETRY TYPE	RADIO MODEM W/ PLC, CELLULAR BACKUP
STANDBY POWER TYPE	50 KW PERMANENT DIESEL STANDBY GENERATOR WITH AUTOMATIC TRANSFER SWITCH
FUEL TANK CAPACITY	203 GALLONS, 48 HOUR CAPACITY
OVERFLOW POINT	STATION WET WELL
OVERFLOW ELEVATION	1269.6 FEET
100-YEAR FLOOD ELEVATIONS	1267.0 FEET
EPA RELIABILITY CLASS	1
FORCE MAIN	
TYPE AND LENGTH	1023 FEET OF 8" DIAMETER CL50 DUCTILE IRON FORCE MAIN
PROFILE DESCRIPTION	CONTINUOUSLY ASCENDING
AIR RELEASE VALVES	NONE
AVERAGE FORCE MAIN DETENTION TIME	31 MINUTES
DISCHARGE LOCATION	SSMH RR16, RR INTERCEPTOR FM STATION 39+40.92'
SULFIDE CONTROL SYSTEM	NONE

SOUTH WELCHES PUMP STATION SYSTEM HEAD AND PUMP CURVES



NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: MBE
CHECKED: EPK
APPROVED: NSL

SHEET 3A-G2 17 of 184

Nicholas S. Lafrenz 98172 REGISTERED PROFESSIONAL ENGINEER OREGON
Date:
RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
DESIGN DATA TABLE AND SYSTEM CURVE

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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QUALITY ASSURANCE PLAN:

QUALITY ASSURANCE AND CONTROL PLAN:

QUALITY ASSURANCE FOR THE STRUCTURE'S SEISMIC RESISTANCE AND MAIN LATERAL FORCE RESISTING SYSTEM SHALL BE ENSURED BY THE REVIEW OF THE FOLLOWING SUBMITTALS, PERFORMING THE LISTED STRUCTURAL OBSERVATIONS AND IMPLEMENTATION OF THE LISTED SPECIAL INSPECTION AND MATERIAL TESTING OF THE FOLLOWING:

SHOP DRAWINGS AND SUBMITTALS:

SHOP DRAWINGS, CALCULATIONS, SUBMITTALS AND/OR MILL CERTIFICATES FOR THE FOLLOWING ITEMS SHALL BE SUBMITTED TO THE OWNER AND ENGINEER OF RECORD FOR REVIEW A MINIMUM OF 21 DAYS PRIOR TO FABRICATION:

1. PREMANUFACTURED ROOF TRUSS SHOP DRAWINGS AND CALCULATIONS

SPECIAL INSPECTIONS:

1. SPECIAL INSPECTIONS SHALL CONFORM TO SECTION 1705 OF THE 2021 OSSC, CONTRACT DOCUMENTS AND APPROVED SUBMITTALS. REFER TO SPECIAL INSPECTION AND TESTING TABLES FOR PROJECT REQUIREMENTS.

2. SPECIAL INSPECTIONS AND ASSOCIATED TESTING SHALL BE PERFORMED BY AN APPROVED ACCREDITED INDEPENDENT AGENCY MEETING THE REQUIREMENTS OF ASTM E329 (MATERIALS). THE INSPECTION AND TESTING AGENCY SHALL FURNISH TO THE ENGINEER OF RECORD A COPY OF THEIR SCOPE OF ACCREDITATION. SPECIAL INSPECTORS SHALL BE APPROVED BY THE BUILDING OFFICIAL. WELDING INSPECTORS SHALL BE QUALIFIED PER SECTION 6.1.4.1(1) OF AWS D1.1.

3. THE SPECIAL INSPECTOR SHALL OBSERVE THE INDICATED WORK FOR COMPLIANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS. ALL DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE CONTRACTOR FOR CORRECTION AND NOTED IN THE INSPECTION REPORTS.

4. THE SPECIAL INSPECTOR AND GEOTECHNICAL ENGINEER SHALL FURNISH INSPECTION REPORTS FOR EACH INSPECTION TO THE BUILDING OFFICIAL, STRUCTURAL ENGINEER, ARCHITECT, CONTRACTOR, AND OWNER. THE SPECIAL INSPECTION AGENCY SHALL SUBMIT A FINAL REPORT STATING THAT THE WORK REQUIRING SPECIAL INSPECTION WAS INSPECTED AND IS IN CONFORMANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS AND THAT ALL DISCREPANCIES NOTED IN THE INSPECTION REPORTS HAVE BEEN CORRECTED.

5. QUALITY ASSURANCE (QA) IS REQURIED FOR STRUCTURAL STEEL ITEMS PER AISC 360 AND 341 UNLESS SPECIFICALLY NOTED OTHERWISE. QUALITY CONTROL (QC) TO BE PROVIDED BY THE FABRICATOR, ERECTOR OR OTHER RESPONSIBLE CONTRACTOR AS APPLICABLE. CONTRACTOR AND SPECIAL INSPECTOR TO DOCUMENT QUALITY CONTROL AS REQUIRED IN AISC 360 SECTION N3 AND AISC 341 SECTION J2.

6. INSPECTION TYPES:
   - 6.1. CONTINUOUS : THE FULL-TIME OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK IS BEING PERFORMED.
   - 6.2. PERIODIC : THE PART-TIME OR INTERMITTENT OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK HAS BEEN OR IS BEING PERFORMED AND AT THE COMPLETION OF THE WORK.
   - 6.3. OBSERVE : OBSERVE THESE FUNCTIONS ON A RANDOM, DAILY BASIS. OPERATIONS NEED NOT BE DELAYED PENDING OBSERVATIONS.
   - 6.4. PERFORM : INSPECTIONS SHALL BE PERFORMED PRIOR TO THE FINAL ACCEPTANCE OF THE ITEM.

7. PERFORM INSPECTION PRIOR TO FINAL ACCEPTANCE OF THE ITEM FOR TEN WELDS TO BE MADE BY A GIVEN WELDER, WITH THE WELDER DEMONSTRATING UNDERSTANDING OF REQUIREMENTS AND POSSESSION OF SKILLS AND TOOLS TO VERIFY THESE ITEMS, THE PERFORM DESIGNATION OF THIS TASK SHALL BE REDUCED TO OBSERVE, AND THE WELDER SHALL PERFORM THIS TASK. SHOULD THE INSPECTOR DETERMINE THAT THE WELDER HAS DISCONTINUED PERFORMANCE OF THIS TASK, THE TASK SHALL BE RETURNED TO PERFORM UNTIL SUCH TIME AS THE INSPECTOR HAS RE-ESTABLISHED ADEQUATE ASSURANCE THAT THE WELDER WILL PERFORM THE INSPECTION TASKS LISTED.

8. SPECIAL INSPECTION OF MECHANICAL POST INSTALLED ANCHORS SHALL BE IN STRICT CONFORMANCE WITH THE ICC REPORT AND MANUFACTURER'S INSTALLATION REQUIREMENTS. ANCHOR INSTALLERS SHALL BE QUALIFIED AS REQUIRED BY JURISDICTION REQUIREMENTS.
   - 8.1. INSPECTION REPORTS SHALL IDENTIFY NAMES OF INSTALLERS.
   - 8.2. SPECIAL INSPECTOR SHALL PROVIDE DOCUMENTATION AT THE END OF ANCHOR INSTALLATIONS STATING THAT THE ANCHORS WERE INSPECTED PER APPROVED ANCHOR EVALUATION REPORT.

9. TESTING ABBREVIATIONS:
   - 9.1. NDT - NON-DESTRUCTIVE TESTING
   - 9.2. C.J.P. - COMPLETE JOINT PENETRATION
   - 9.3. MT - MAGNETIC PARTICLE TESTING
   - 9.4. RBS - REDUCED BEAM SECTION

10. DOCUMENT (D): INDICATES CONTRACTOR AND SPECIAL INSPECTOR TO PROVIDE DOCUMENTATION IN ACCORDANCE WITH AISC 341.

STRUCTURAL OBSERVATION REQUIREMENTS:

1. THE OWNER SHALL EMPLOY THE ENGINEER OF RECORD OR AN ALTERNATE OREGON LICENSED PROFESSIONAL ENGINEER, APPROVED BY THE ENGINEER OF RECORD, TO PERFORM STRUCTURAL OBSERVATIONS IN ACCORDANCE WITH SECTION 1704.6 OF THE INTERNATIONAL BUILDING CODE.

2. STRUCTURAL OBSERVATION IS THE VISUAL OBSERVATION OF THE STRUCTURAL SYSTEM BY A REGISTERED DESIGN PROFESSIONAL FOR GENERAL CONFORMANCE TO THE APPROVED CONSTRUCTION DOCUMENTS AT SIGNIFICANT CONSTRUCTION STAGES AND AT COMPLETION OF THE STRUCTURAL SYSTEM. STRUCTURAL OBSERVATION DOES NOT INCLUDE OR WAIVE THE RESPONSIBILITY FOR ANY OTHER INSPECTION CRITERIA, INCLUDING SPECIAL INSPECTION, AS REQUIRED BY THE BUILDING OFFICIAL OR AS INDICATED WITHIN THE INTERNATIONAL BUILDING CODE.

3. DEFICIENCIES SHALL BE REPORTED IN WRITING TO THE OWNER AND THE BUILDING OFFICIAL (AND THE ENGINEER OF RECORD IF AN ALTERNATE ENGINEER IS USED FOR STRUCTURAL OBSERVATION). AT THE CONCLUSION OF THE STRUCTURAL WORK INCLUDED WITHIN THE PERMIT, THE STRUCTURAL OBSERVER SHALL SUBMIT TO THE BUILDING OFFICIAL AND THE OWNER (AND THE ENGINEER OF RECORD IF AN ALTERNATE ENGINEER IS USED FOR STRUCTURAL OBSERVATION) A WRITTEN STATEMENT THAT THE SITE VISITS HAVE BEEN MADE AND IDENTIFY ANY REPORTED DEFICIENCIES WHICH, TO THE BEST OF THE STRUCTURAL OBSERVER'S KNOWLEDGE, HAVE NOT BEEN RESOLVED.

4. THE CONTRACTOR SHALL MAKE AVAILABLE ALL MEANS AND METHODS NECESSARY FOR THE STRUCTURAL OBSERVER TO PERFORM THE REQUIRED STRUCTURAL OBSERVATIONS. IN ADDITION, THE CONTRACTOR SHALL NOTIFY THE OWNER AND STRUCTURAL OBSERVER A MINIMUM OF 48 HOURS BEFORE THE TIME AT WHICH THE SPECIFIED STRUCTURAL OBSERVATIONS MAY BE PERFORMED. IN ADDITION THE CONTRACTOR SHALL UPDATE THE STRUCTURAL OBSERVER OF THE CONSTRUCTION PROGRESS.

5. STRUCTURAL OBSERVATIONS SHALL BE PERFORMED FOR THE FOLLOWING AREAS OF WORK:
   - 5.1. FOLLOWING THE INSTALLATION OF ROOF FRAMING/SHEATHING, PRIOR TO THE INSTALLATION OF FINISHES
   - 5.2. FOLLOWING THE COMPLETION OF ALL STRUCTURAL ELEMENTS CONTAINED HEREIN.

GENERAL - SPECIAL INSPECTIONS

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6)		REMARKS
			CONTINUOUS	PERIODIC	
DEFERRED SUBMITTALS				X	SPECIAL INSPECTION REQUIREMENTS FOR DEFERRED SUBMITTAL ITEMS, INCLUDING REQUIREMENTS FOR DESIGNATED SEISMIC SYSTEMS IN ACCORDANCE WITH OSSC SECTION 1705.12.4 IF APPLICABLE, TO BE SPECIFIED BY THE SYSTEM ENGINEER AND INCLUDED WITH DEFERRED SUBMITTAL DOCUMENTS.
SUBMITTALS TO THE BUILDING OFFICIAL	1704.5			X	CERTIFICATES OF COMPLIANCE, REPORTS OF PRE-CONSTRUCTION TESTS, OR REPORTS OF MATERIAL PROPERTIES SHALL BE SUBMITTED TO THE BUILDING OFFICIAL.
POST INSTALLED MECHANICAL ANCHORS AND ADHESIVE ANCHORS IN HARDENED CONCRETE AND COMPLETED MASONRY				X	

REQUIRED SPECIAL INSPECTIONS for SEISMIC RESISTANCE

SYSTEM or MATERIAL	INSPECTION				REMARKS
	IBC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6)		
			CONTINUOUS	PERIODIC	
ARCHITECTURAL COMPONENTS					
INSTALLATION OF ANCHORAGE OF STORAGE RACKS 8 FEET OR GREATER IN HEIGHT IN STRUCTURES	1705.13.7 TABLE 1705.13.7	ASCE 7-16 SECTION 15.5.3		X	
INSTALLATION OF OTHER SEISMIC SUPPORTS FOR ARCHITECTURAL SYSTEMS AND THEIR COMPONENTS	1705.13.5			X	

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PETERSON STRUCTURAL ENGINEERS

NO.	DATE	REVISION	BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3A-G3 18 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2021 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE 0 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
STRUCTURAL QUALITY ASSURANCE PLAN

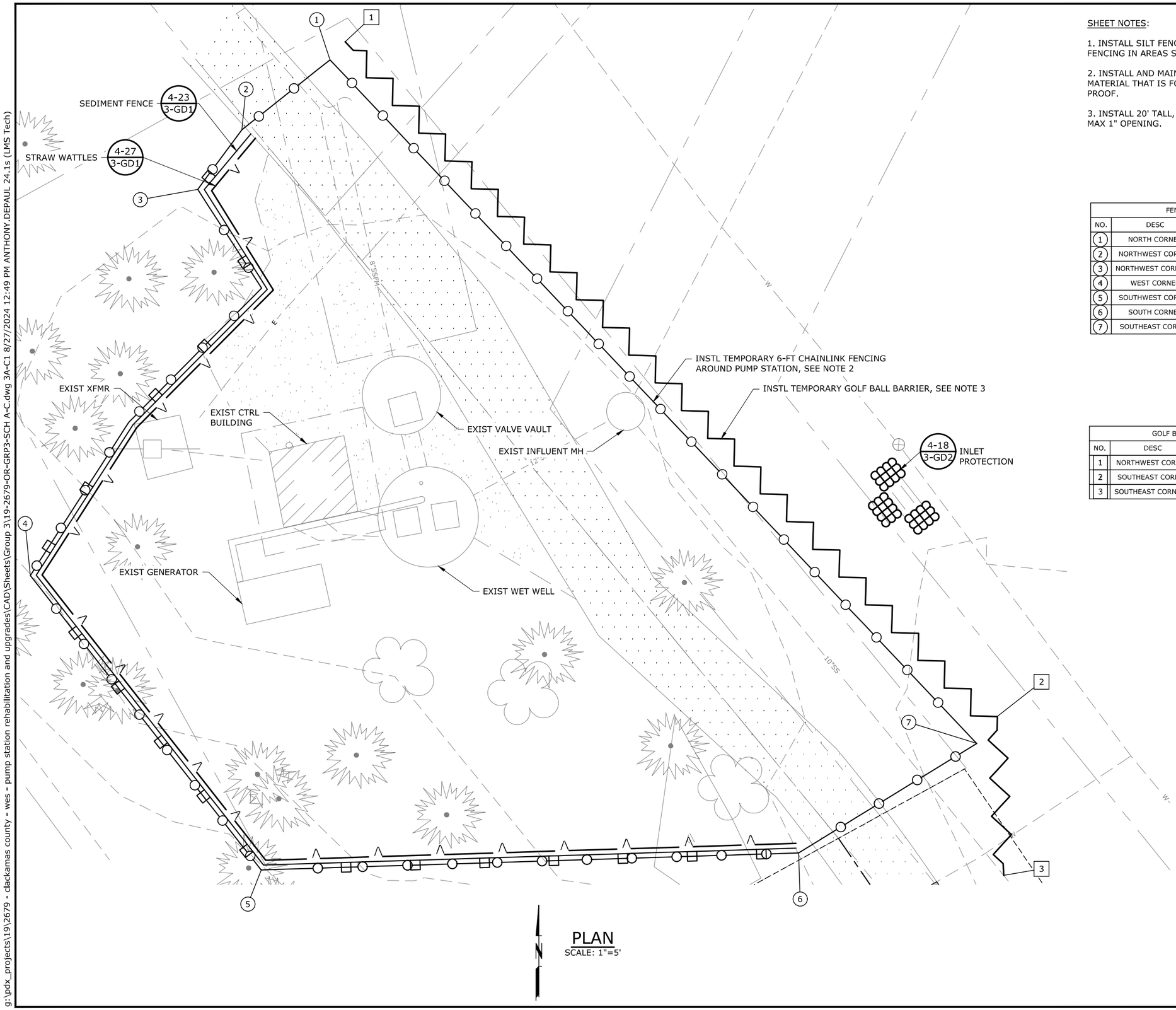
consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Updated Drawings\2025_05_05 Group 3 Final Drawings R2 1901-0206.dwg 3A-G3 5/6/2025 2:11 PM SAMRICHMANN 24.2s (LMS Tech)



PLAN
SCALE: 1"=5'

SHEET NOTES:

1. INSTALL SILT FENCE AND STRAW WATTLES INSIDE OF TEMPORARY FENCING IN AREAS SHOWN.

2. INSTALL AND MAINTAIN TEMPORARY FENCE PRIVACY SCREEN MATERIAL THAT IS FOREST GREEN IN COLOR, UV RESISTANT, AND WIND PROOF.

3. INSTALL 20' TALL, 28 MM MESH NETTING WITH POST AS SHOWN WITH MAX 1" OPENING.

FENCE POINT TABLE			
NO.	DESC	NORTHING	EASTING
1	NORTH CORNER	611778.1627	7824474.5637
2	NORTHWEST CORNER	611770.8330	7824465.3331
3	NORTHWEST CORNER 2	611764.6004	7824460.7136
4	WEST CORNER	611724.1871	7824443.1818
5	SOUTHWEST CORNER	611693.3721	7824467.3573
6	SOUTH CORNER	611695.1510	7824523.6315
7	SOUTHEAST CORNER	611706.6107	7824542.2869

GOLF BALL BARRIER TABLE			
NO.	DESC	NORTHING	EASTING
1	NORTHWEST CORNER	611780.0592	7824476.1545
2	SOUTHEAST CORNER	611709.4167	7824544.4571
3	SOUTHEAST CORNER 2	611692.7927	7824545.1121

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

REGISTERED PROFESSIONAL ENGINEER
OREGON
98172
Nicholas S. Lafrenz
Date:
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
SITE PREPARATION AND EROSION CONTROL PLAN

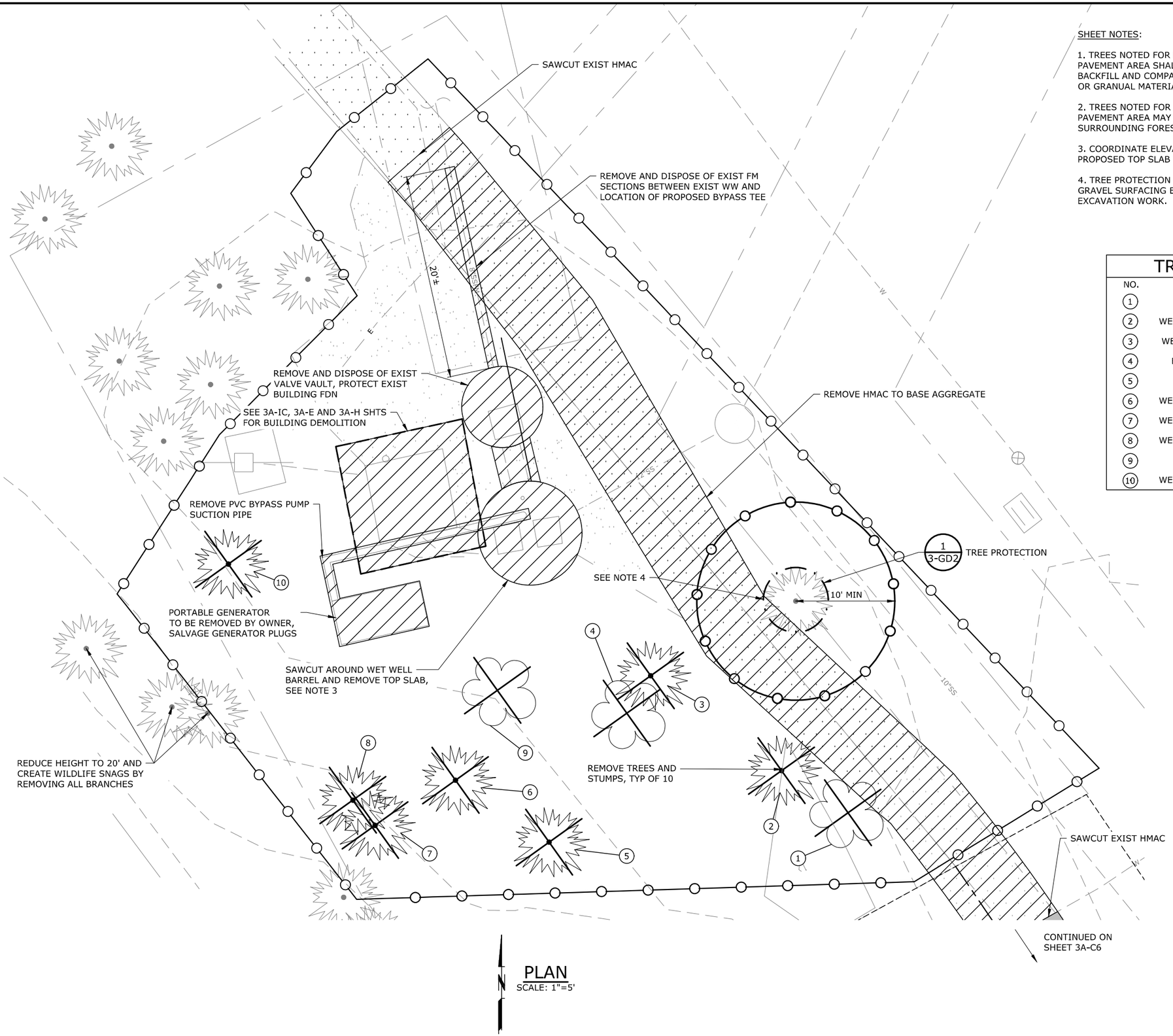
consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 | DATE: MAY 2025

SHEET 3A-C1 19 of 184

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabiltation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH A-C.dwg 3A-C1 8/27/2024 12:49 PM ANTHONY.DEPAUL 24.1s (LMS Tech)



SHEET NOTES:

1. TREES NOTED FOR REMOVAL THAT ARE WITHIN THE PROPOSED PAVEMENT AREA SHALL INCLUDE THE STUMP AND MAJOR ROOTS. BACKFILL AND COMPACT TO SUBGRADE ELEVATION WITH SELECT NATIVE OR GRANUAL MATERIAL.

2. TREES NOTED FOR REMOVAL THAT ARE OUTSIDE OF THE PROPOSED PAVEMENT AREA MAY HAVE STUMPS GROUND AND SPREAD OUT IN THE SURROUNDING FOREST AREA.

3. COORDINATE ELEVATION OF SAWCUT WITH THICKNESS OF THE PROPOSED TOP SLAB TO MEET THE RIM FINISH GRADE SHOWN ON 3A-C5.

4. TREE PROTECTION FENCING THAT CROSSES PROPOSED PAVING OR GRAVEL SURFACING BOUNDARIES SHALL BE REMOVED PRIOR TO EXCAVATION WORK.

TREE TABLE

NO.	TYPE	DBH (IN.)
1	RED ALDER	6
2	WESTERN REDCEDAR	22
3	WESTERN HEMLOCK	18
4	BIGLEAF MAPLE	12, 11
5	DOUGLAS-FIR	21
6	WESTERN REDCEDAR	24
7	WESTERN REDCEDAR	18
8	WESTERN REDCEDAR	18
9	RED ALDER	10
10	WESTERN REDCEDAR	14

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-C2 20 of 184

REGISTERED PROFESSIONAL ENGINEER 98128 OREGON Nicholas S. Lafrenz Date: 12-31-26

REGISTERED PROFESSIONAL LAND SURVEYOR 88000 OREGON Date: RENEWS 12-31-26

SCALE | VERT: AS SHOWN | HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION SITE DEMOLITION PLAN

consor

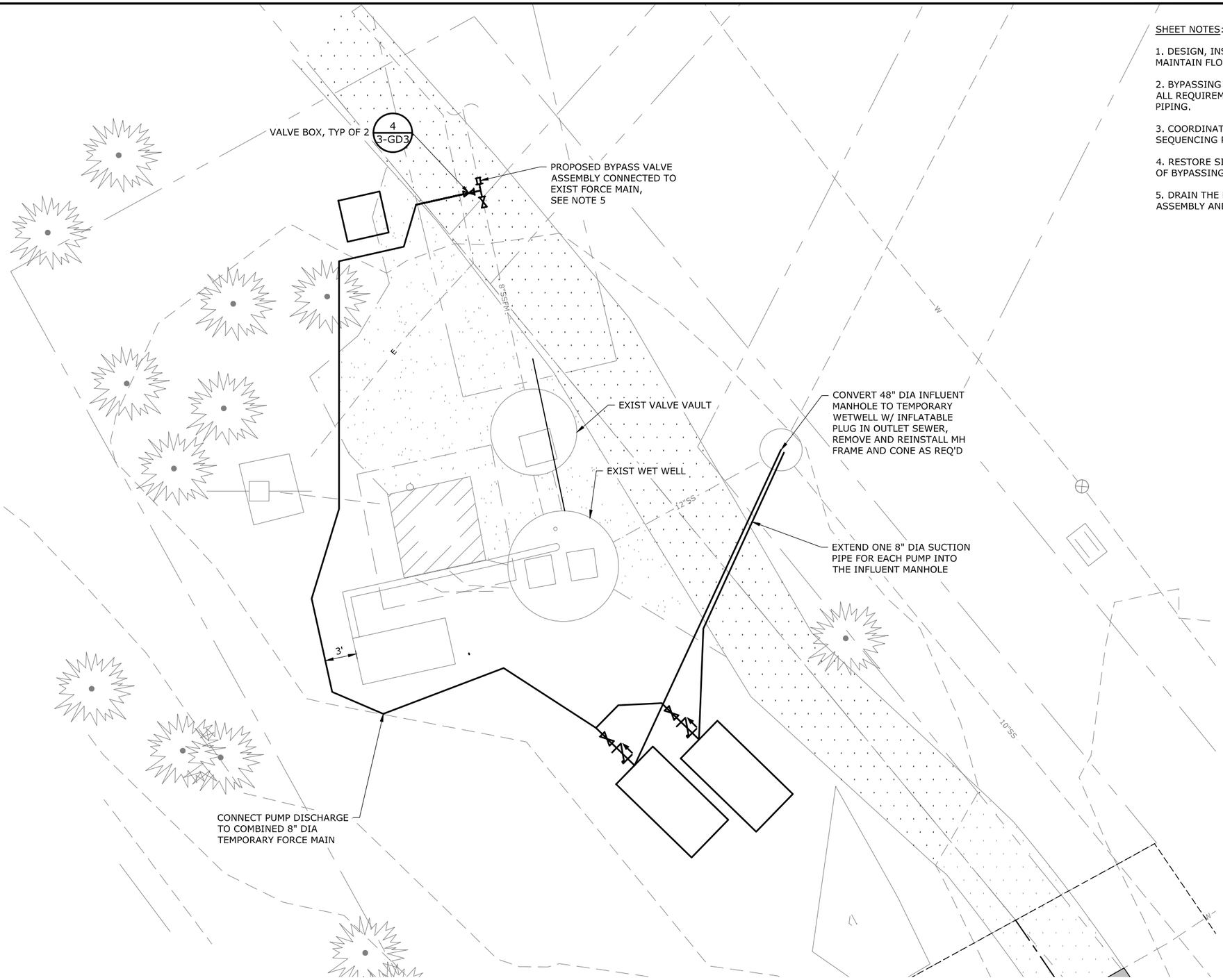
DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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PLAN
SCALE: 1"=5'

SHEET NOTES:

1. DESIGN, INSTALL, AND MAINTAIN BYPASS PUMPING SYSTEM TO MAINTAIN FLOWS AT ALL TIME PER SECTION 01 57 19.11.

2. BYPASSING PLAN IS SCHEMATIC AND NOT INTENDED TO SHOW ALL REQUIREMENTS OR ACTUAL PLACEMENT OF EQUIPMENT AND PIPING.

3. COORDINATED BYPASSING INSTALLATION WITH WORK SEQUENCING PER SECTION 01 12 16.

4. RESTORE SITE SURFACING AND GRADES FOLLOWING REMOVAL OF BYPASSING EQUIPMENT.

5. DRAIN THE FORCE MAIN AND INSTALL A BYPASS VALVE ASSEMBLY AND CONNECTION AS SHOWN ON SHEET 3A-M1.

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-C3
21 of 184

REGISTERED PROFESSIONAL ENGINEER
98172
Nicholas S. Lafrenz
OREGON
Date:
RENEWS 12-31-26

REGISTERED PROFESSIONAL ENGINEER
ILLINOIS
NICHOLAS S. LAFRENZ
062-080606
RENEWAL 11/30/2025

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

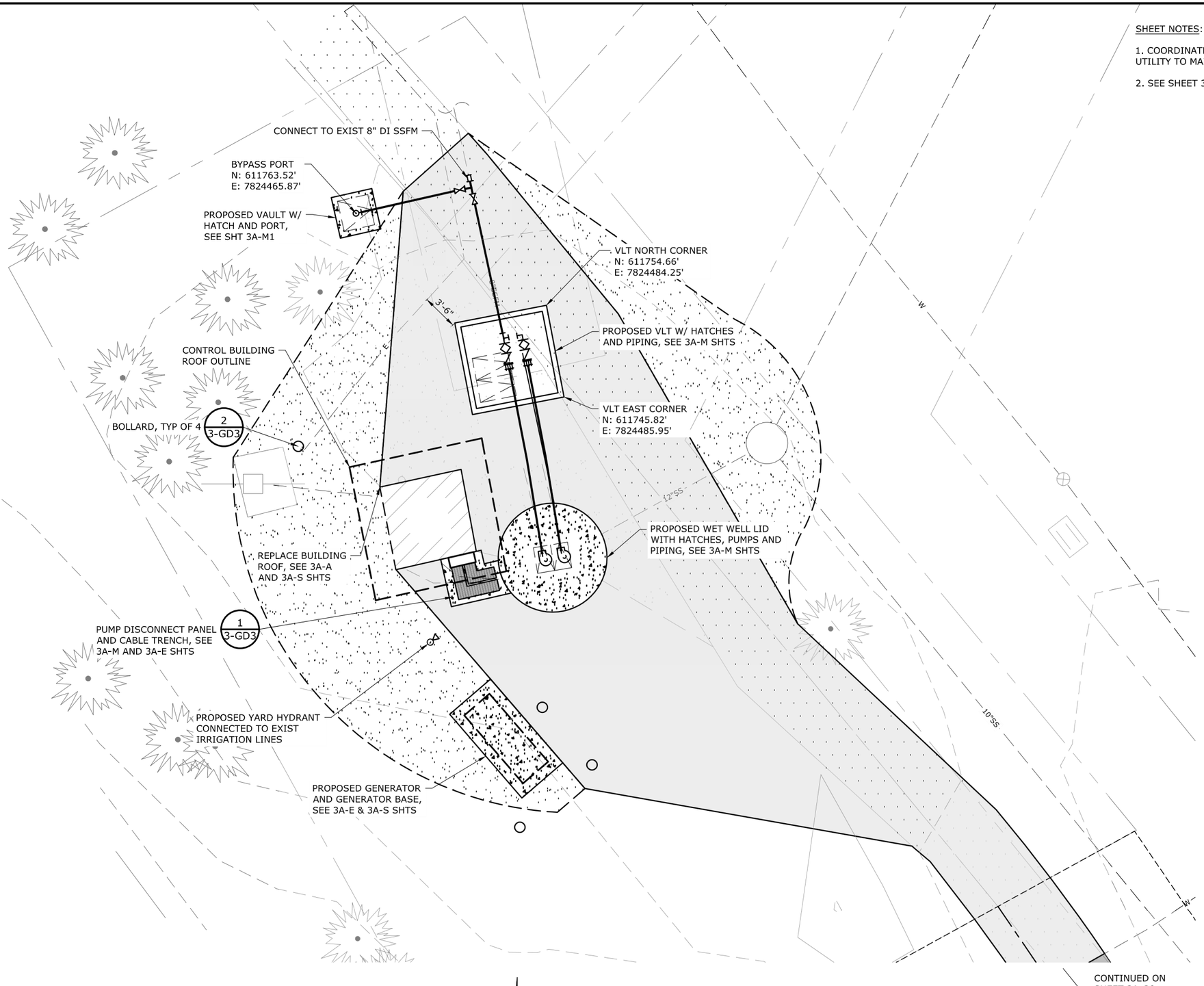
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
BYPASS PUMPING PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025



PLAN
SCALE: 1"=5'

SHEET NOTES:

1. COORDINATE FINAL BOLLARD LOCATIONS WITH OWNER AND UTILITY TO MAINTAIN SEPARATION REQUIREMENTS.

2. SEE SHEET 3A-C5 FOR GRADING AND SURFACING INFORMATION.

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-C4
22 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
98125
Nicholas A. Laferriere
Date:
RENEWS 12-31-26

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 12, 2005
LLOYD J. PURDY
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0
1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
SITE PLAN

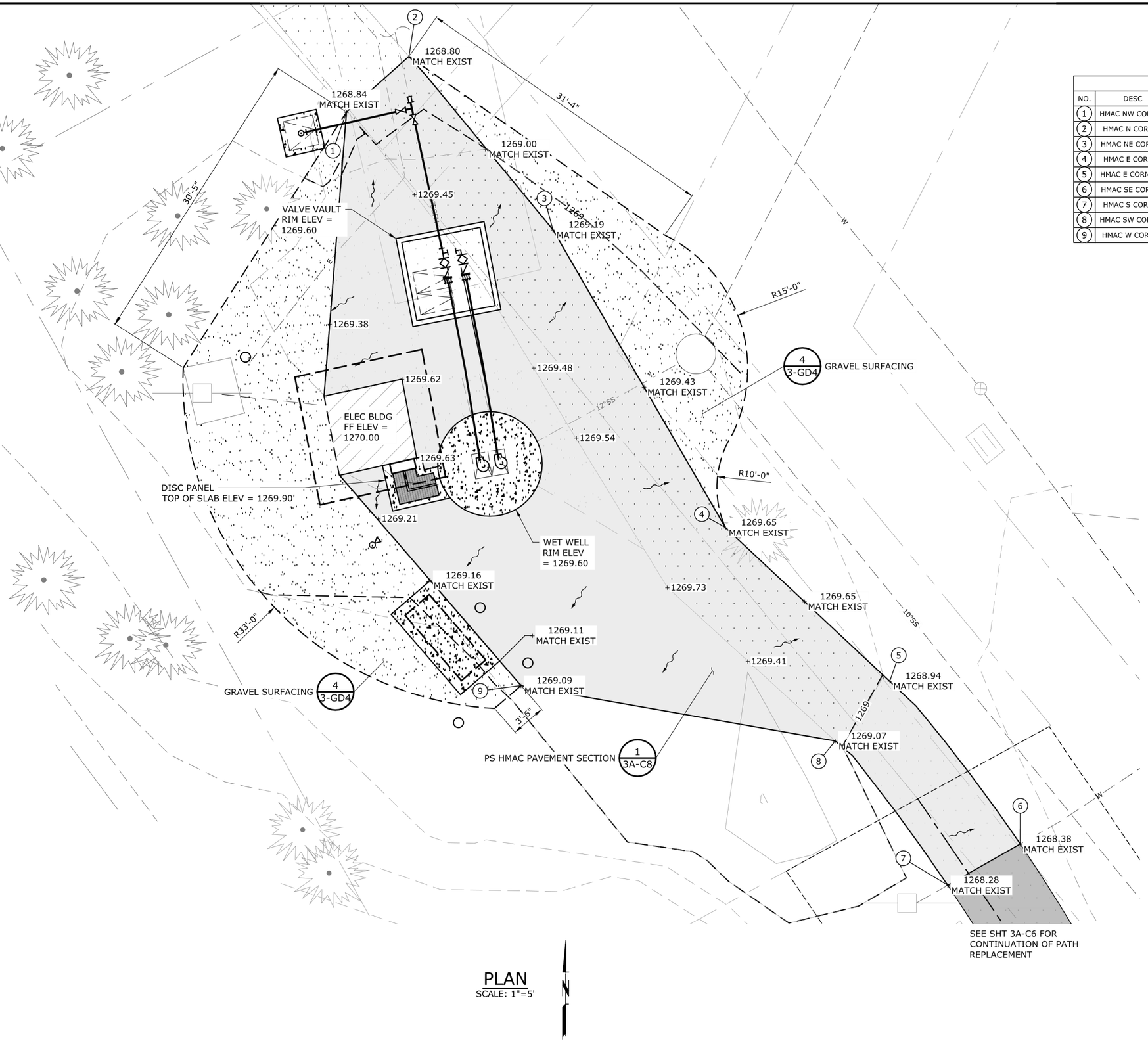
consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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HMAC CORNERS			
NO.	DESC	NORTHING	EASTING
1	HMAC NW CORNER	611765.6504	7824470.4388
2	HMAC N CORNER	611771.2464	7824476.7166
3	HMAC NE CORNER	611753.8387	7824491.1723
4	HMAC E CORNER	611723.9284	7824508.4946
5	HMAC E CORNER 2	611708.4334	7824525.0465
6	HMAC SE CORNER	611692.1415	7824538.1036
7	HMAC S CORNER	611688.0040	7824530.8224
8	HMAC SW CORNER	611702.4988	7824519.5250
9	HMAC W CORNER	611708.0556	7824487.9658

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-C5 23 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
98126PE
Nicholas S. Lafrenz
Date:
RENEWS 12-31-26

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT
OREGON
Nicholas S. Lafrenz
Date:

SCALE | VERT: AS SHOWN | HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
SURFACING AND GRADING PLAN

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

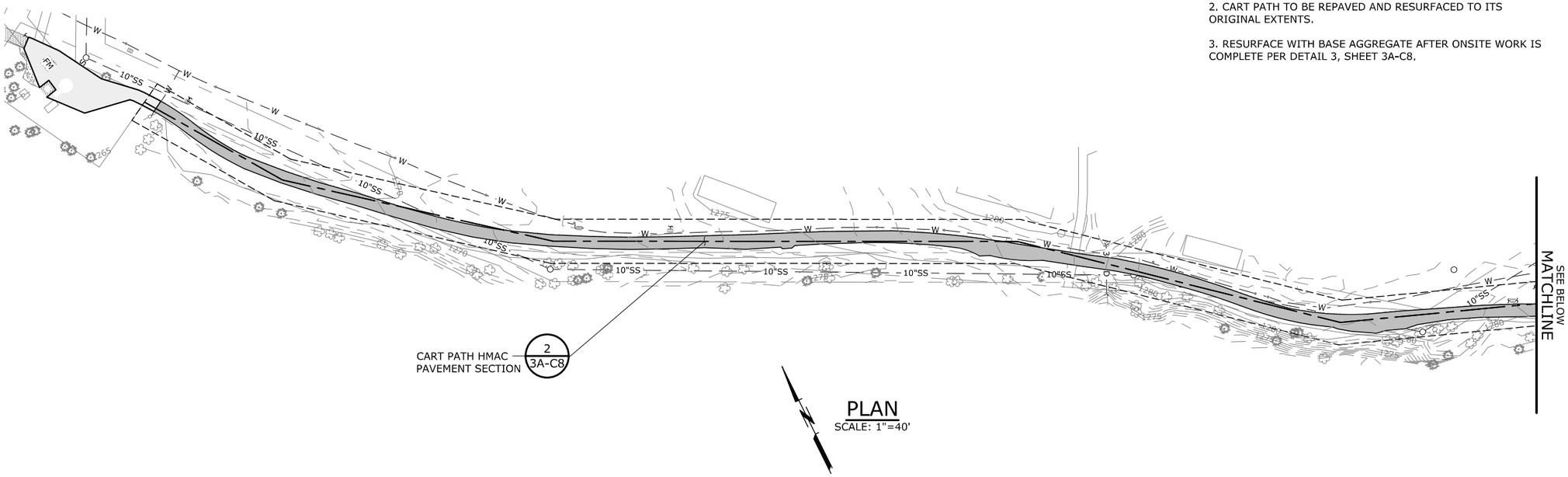
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SHEET NOTES:

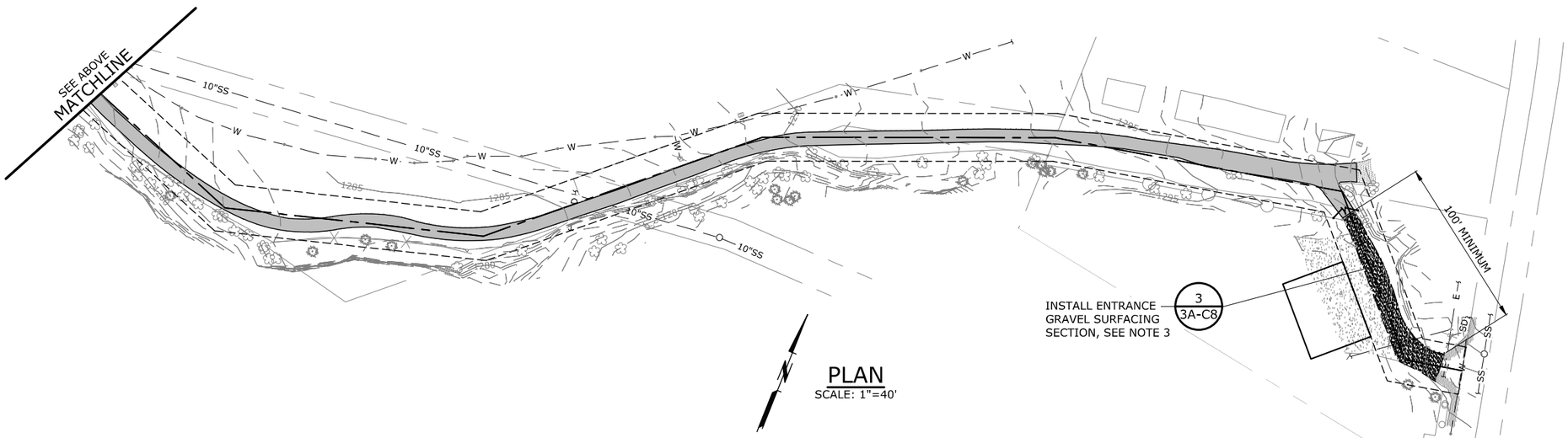
1. TREE BRANCHES AND OTHER PLANTS CROSSING INTO THE GOLF CART PATH SHALL BE NEATLY TRIMMED BACK TO A SAFE HORIZONTAL AND VERTICAL DISTANCE AWAY FROM THE PATH TO PREVENT COLLISION WITH CONSTRUCTION VEHICLES MOVING TO AND FROM THE SITE THROUGHOUT CONSTRUCTION.

2. CART PATH TO BE REPAVED AND RESURFACED TO ITS ORIGINAL EXTENTS.

3. RESURFACE WITH BASE AGGREGATE AFTER ONSITE WORK IS COMPLETE PER DETAIL 3, SHEET 3A-C8.



PLAN
SCALE: 1"=40'



PLAN
SCALE: 1"=40'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-C6 24 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 31, 2001
Nicholas S. Lafrenz
Date: 12-31-26
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
PUMP STATION ACCESS PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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SHEET NOTES:

1. 40x50 TEMPORARY CONSTRUCTION EASEMENT PROVIDED ON GOLF COURSE PROPERTY FOR CONSTRUCTION STAGING.

PLAN
SCALE: 1"=40'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-C7 25 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98127 — Nicholas S. Lafrenz — Date: 06/30/25 — RENEWS 12-31-26

REGISTERED LICENSED LAND SURVEYOR — OREGON — JULY 13, 2005 — LLOYD J. HIBNER — RENEWS 6/30/2026

SCALE: VERT: AS SHOWN, HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

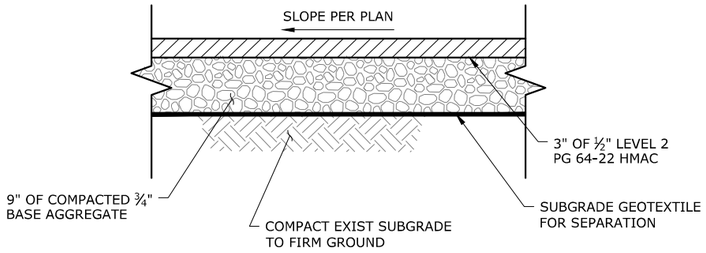
SOUTH WELCHES PUMP STATION
CONSTRUCTION ENTRANCE AND STAGING AREA PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

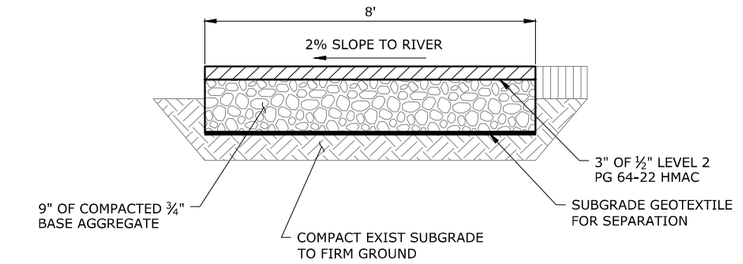
PROJECT: 19-2679 DATE: MAY 2025

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PS HMAC PAVEMENT SECTION (1 / 3A-C5)

SCALE: NTS



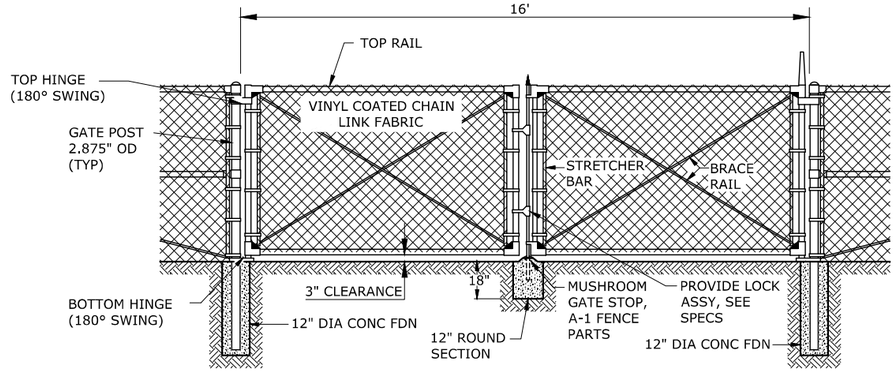
CART PATH HMAC PAVEMENT SECTION (2 / 3A-C6)

SCALE: NTS



ENTRANCE GRAVEL SURFACING SECTION (3 / 3A-C6)

SCALE: NTS



NOTE:

1. PROVIDE LOCK ASSEMBLY AND GATE STOP FOR EACH GATE, SEE SPECIFICATIONS.

DOUBLE SWING GATE (4 / 3A-C7)

SCALE: NTS

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-C8 26 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98172 — Nicholas Alexander Laferriere — RENEWS 12-31-26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

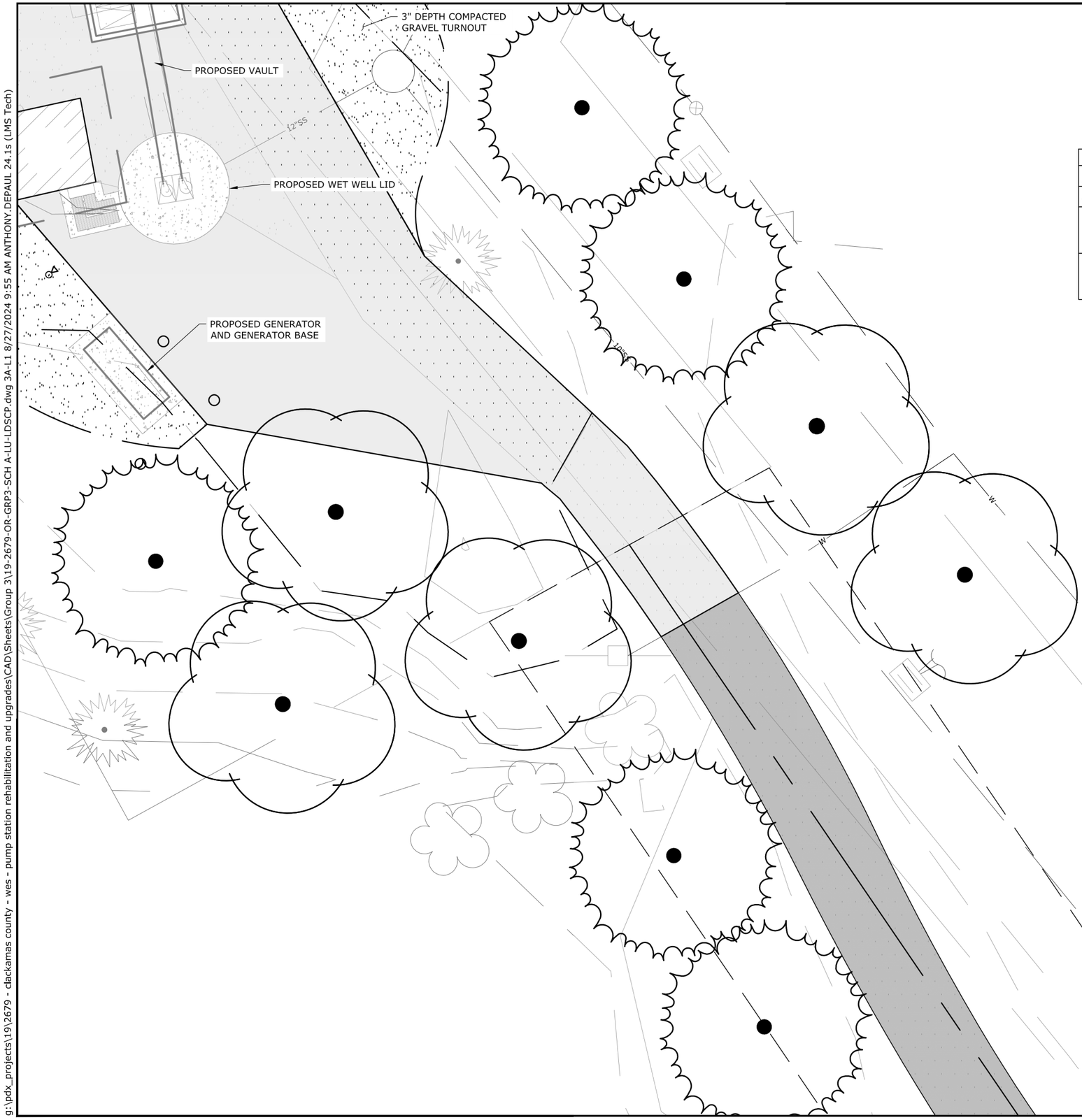
SOUTH WELCHES PUMP STATION
CIVIL DETAILS

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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PLANT SCHEDULE				
SYMBOL	CODE	BOTANICAL / COMMON NAME	PLANTING SIZE	QTY
TREES				
	ALN RUB	ALNUS RUBRA / RED ALDER	1" CAL.	5
	THU ATR	THUJA PLICATA 'ATROVIRENS' / WESTERN RED CEDAR	6` HT.	5

NOTES:

1. SEE SHEET 3A-L2 FOR PLANTING DETAILS.

PLAN
SCALE: 1"=5'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-L1 27 of 184

REGISTERED LANDSCAPE ARCHITECT
748
Kristofy Ingerz
by Nicholas S
OREGON
2025.05.30
EXPIRES: 6-54-2026
RENEWS 5-31-25

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

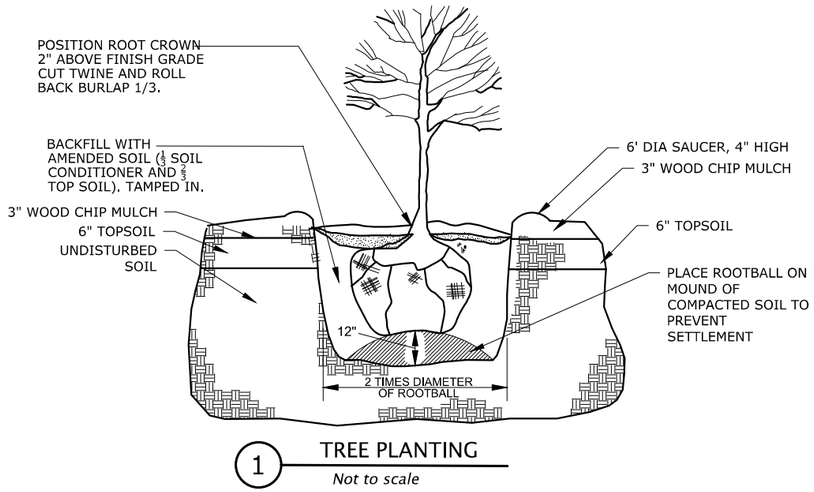
SOUTH WELCHES PUMP STATION LANDSCAPING PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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1 TREE PLANTING

Not to scale

PLANTING METHODS:

1. SOIL PREPARATION: TILL THE SUB-GRADE IN THESE AREAS TO A DEPTH OF AT LEAST FOUR INCHES AND ADD AT LEAST 12 INCHES OF CLEAN COMPOST-AMENDED TOPSOIL. THE COMPOST-AMENDED TOPSOIL SHALL HAVE A GOOD GROWING MEDIUM WITH TEXTURE MATERIAL THAT PASSES THROUGH ONE-INCH AND 35% ORGANIC MATTER FERTILITY.

2. PLANTING TIME: CONTAINERIZED STOCK SHALL BE INSTALLED ONLY FROM MARCH 1 THROUGH MAY 15 AND OCTOBER 1 THROUGH NOVEMBER 15. PLANTINGS OUTSIDE THESE TIMES MAY REQUIRE ADDITIONAL MEASURES APPROVED BY THE ENGINEER TO ENSURE PLANTS SURVIVAL.

3. All PLANTS SHALL BE INSTALLED IN ACCORDANCE WITH AMERICAN NURSERYMAN STANDARDS. INSTALLED PLANTS SHALL TAGGED FOR DORMANT SEASON IDENTIFICATION AND SHALL REMAIN ON PLANT MATERIALS AFTER PLANTING FOR MONITORING PURPOSES.

4. IF NEEDED, INSTALL STAKES TO SUPPORT TREES DURING PLANT ESTABLISHMENT PERIOD.

5. EROSION CONTROL: GRADING, SOIL PREPARATION, AND SEEDING SHALL BE PERFORMED DURING OPTIMAL WEATHER CONDITIONS AND AT LOW FLOW LEVELS TO MINIMIZE SEDIMENT IMPACTS.

6. MULCHING: TREES, SHRUBS, AND GROUNDCOVER AREAS SHALL BE MULCHED A MINIMUM OF THREE INCHES IN DEPTH AND 18 INCHES IN DIAMETER, TO RETAIN MOISTURE AND DISCOURAGE WEED GROWTH AROUND NEWLY INSTALLED PLANT MATERIAL. APPROPRIATE MULCHES ARE MADE FROM COMPOSTED BARK OR LEAVES THAT HAVE NOT BEEN CHEMICALLY TREATED.

7. WEED CONTROL: THE REMOVAL OF NUISANCE AND INVASIVE WEEDS SHALL BE NECESSARY THROUGHOUT THE MAINTENANCE PERIOD, AND UNTIL A HEALTHY STAND OF DESIRABLE VEGETATION IS ESTABLISHED.

8. PLANT REPLACEMENT AND PRESERVATION: INSTALLED PLANTS THAT ARE UNHEALTHY OR DAMAGED SHALL BE REPLACED DURING THE MAINTENANCE PERIOD. PRIOR TO REPLACEMENT, THE CAUSE OF LOSS (WILDLIFE DAMAGE, POOR PLANT STOCK, ETC.) SHALL BE DOCUMENTED WITH A DESCRIPTION OF THE CORRECTIVE ACTIONS TAKEN.

PLANTS MAINTENANCE NOTES:

1. THE CONTRACTOR SHALL INSTALL A DRIP IRRIGATION SYSTEM TO WATER PLANTS.

2. THE OWNER SHALL BE RESPONSIBLE FOR OPERATING AND MAINTAINING THE IRRIGATION SYSTEM TO KEEP PLANTS HEALTHY AND IN GOOD GROWING CONDITIONS.

3. THERE WILL BE NO PLANT ESTABLISHMENT PERIOD. THE OWNER SHALL BE RESPONSIBLE FOR ALL PLANTS MAINTENANCE SUCH AS WEEDING AND REPLACEMENT OF ANY DAMAGED OR DEAD PLANTS.

NO.	DATE	REVISION	BY

DESIGNED: FE
DRAWN: FE
CHECKED: DAM
APPROVED: XXX

SHEET 3A-L2 28 of 184

REGISTERED LANDSCAPE ARCHITECT
OREGON
Kristofer Hartz
RENEWS 5-31-25

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

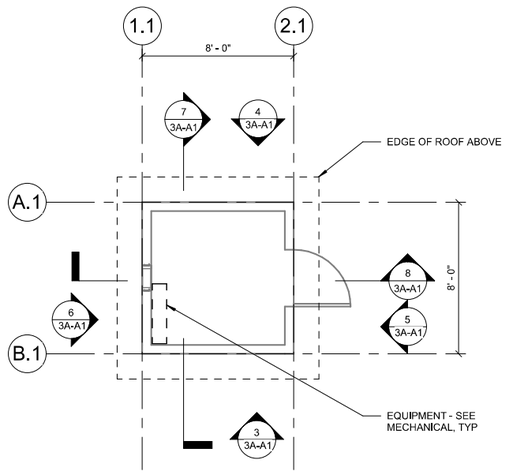
SOUTH WELCHES PUMP STATION
LANDSCAPING DETAILS

consor

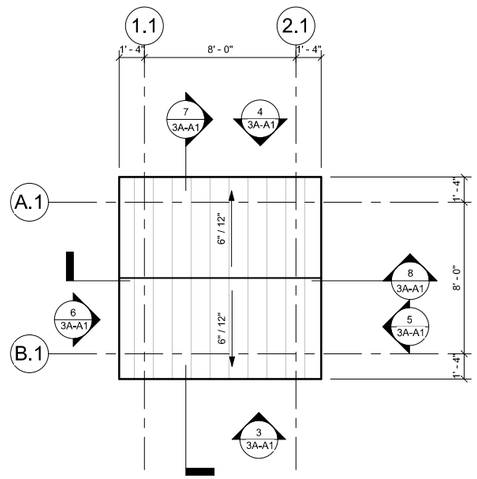
CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

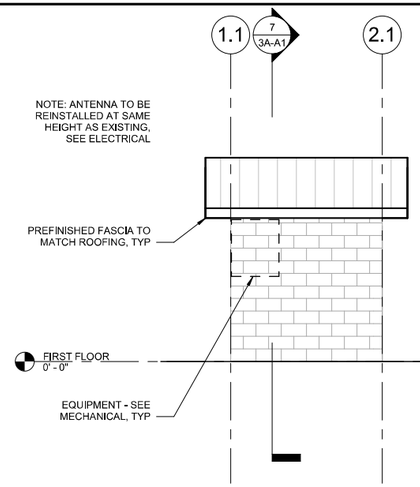
g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH A-LU-LDSCP.dwg 3A-L2 8/27/2024 9:55 AM ANTHONY.DEPAUL 24.1s (LMS Tech)



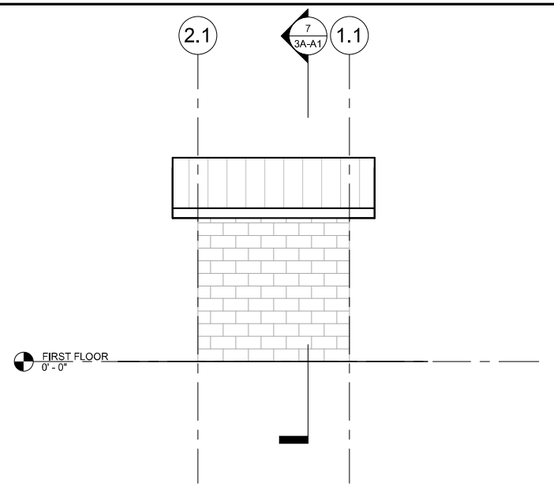
1 FIRST FLOOR PLAN
SCALE: 1/4" = 1'-0"



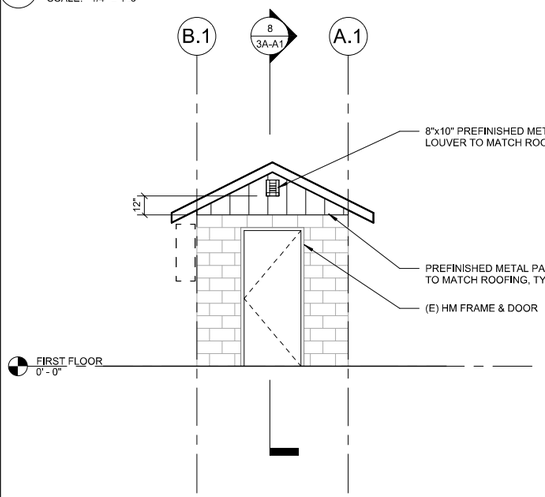
2 ROOF PLAN
SCALE: 1/4" = 1'-0"



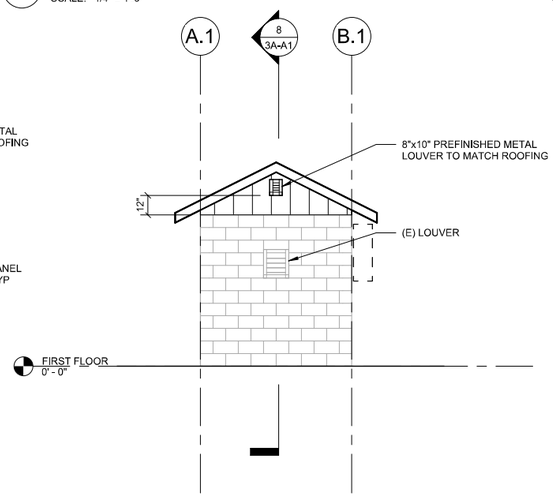
3 EXTERIOR ELEVATION - SOUTH
SCALE: 1/4" = 1'-0"



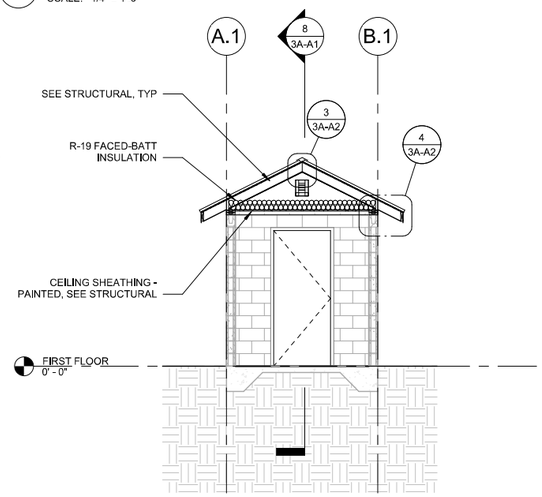
4 EXTERIOR ELEVATION - NORTH
SCALE: 1/4" = 1'-0"



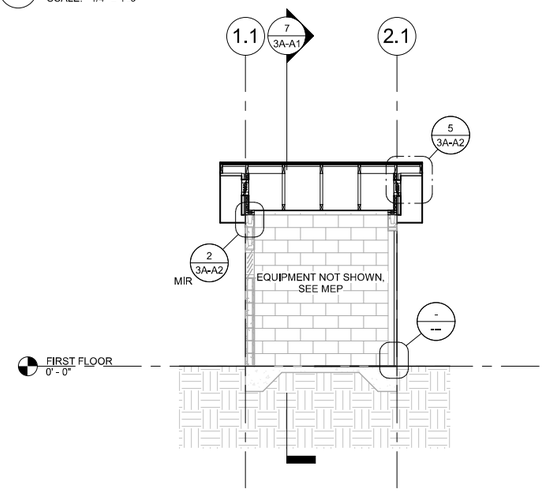
5 EXTERIOR ELEVATION - EAST
SCALE: 1/4" = 1'-0"



6 EXTERIOR ELEVATION - WEST
SCALE: 1/4" = 1'-0"



7 TRANSVERSE SECTION
SCALE: 1/4" = 1'-0"



8 LONGITUDINAL SECTION
SCALE: 1/4" = 1'-0"

C:\Users\human\Strongwork Dropbox_ACTIVE PROJECTS_21001_WES Pump Stations Upgrade\WES Group III\Design Information\21001_WES PS_R23.rvt

mwa architects

NO.	DATE	REVISION	BY
1			

DESIGNED: MD
DRAWN: DH
CHECKED: MD
APPROVED: AA

SHEET 3A-A1
29 of 184

REGISTERED ARCHITECT ALAN P. ARMSTRONG PORTLAND, OREGON STATE OF OREGON

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

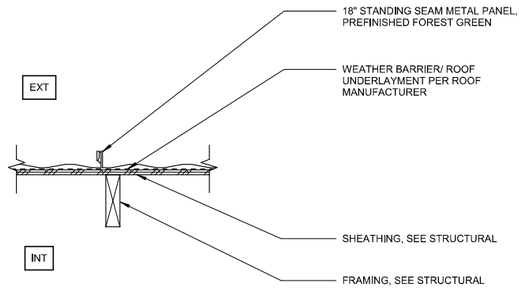
PUMP STATION REHABILITION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION FLOOR AND ROOF PLANS, ELEVATIONS AND SECTIONS

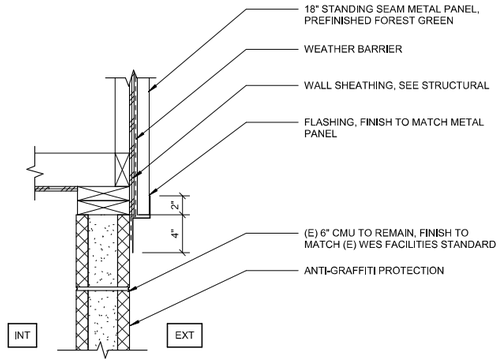
consor

CLACKAMAS WATER ENVIRONMENT SERVICES

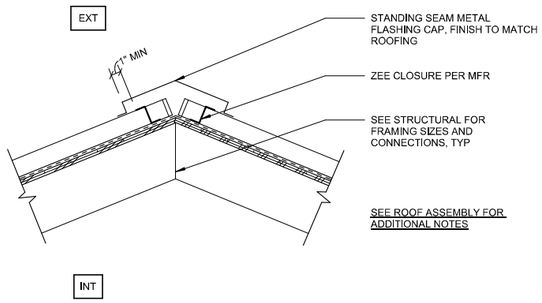
PROJECT: 19-2679
DATE: May 2025



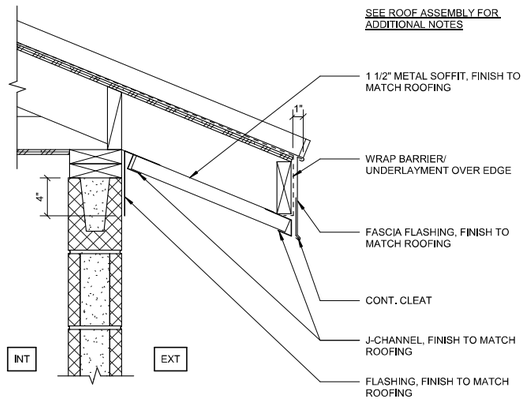
1 TYP ROOF ASSEMBLY
SCALE: 1 1/2" = 1'-0"



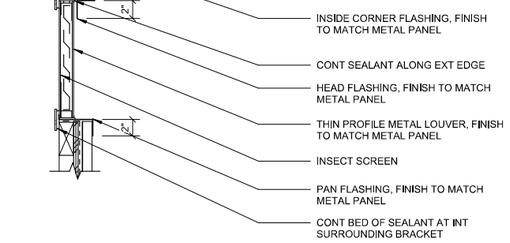
2 TYP WALL ASSEMBLY
SCALE: 1 1/2" = 1'-0"



3 ROOF RIDGE
SCALE: 1 1/2" = 1'-0"



4 ROOF EAVE
SCALE: 1 1/2" = 1'-0"



5 LOUVER AND RAKE EDGE
SCALE: 1 1/2" = 1'-0"

C:\Users\human\Strongwork Dropbox_ACTIVE PROJECTS_21001_WES Pump Stations Upgrade\WES Group III\Design Information\21001_WES PS_R23.rvt

mwa architects

NO.	DATE	REVISION	BY
1			

DESIGNED: MD
DRAWN: DH
CHECKED: MD
APPROVED: AA

SHEET 3A-A2
30 of 184

REGISTERED ARCHITECT ALAN P. ARMSTRONG PORTLAND, OREGON STATE OF OREGON

SCALE VERT: AS SHOWN HORIZ:AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

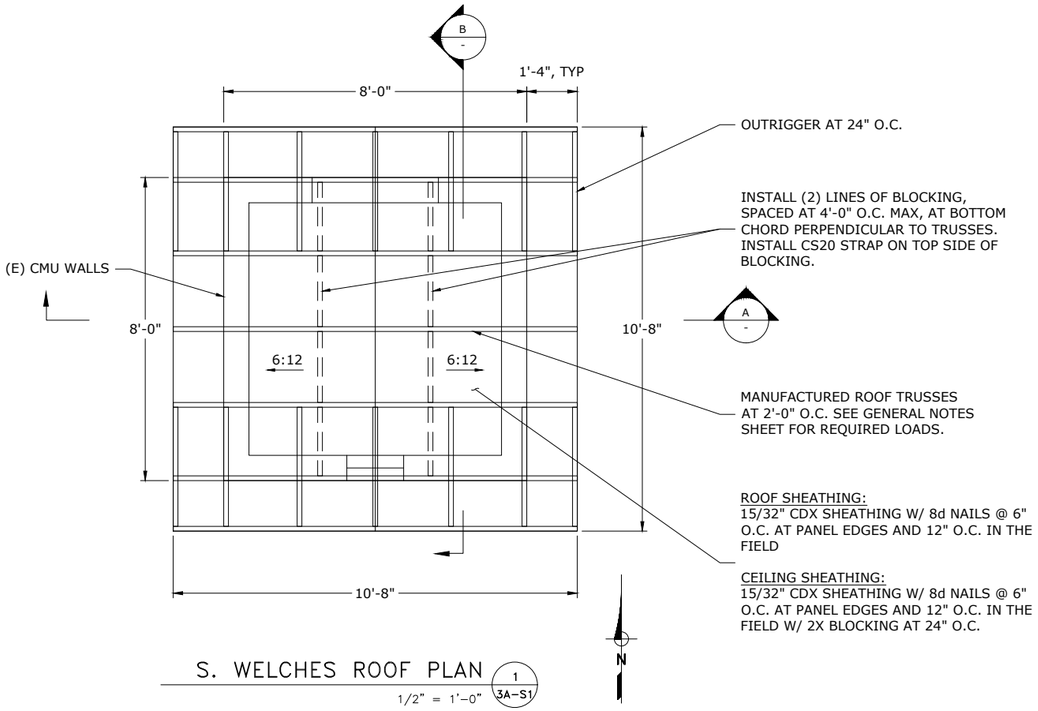
PUMP STATION REHABILITION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION ARCHITECTURAL ASSEMBLIES AND DETAILS

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: May 2025



S. WELCHES ROOF PLAN (1 / 3A-S1)

1/2" = 1'-0"

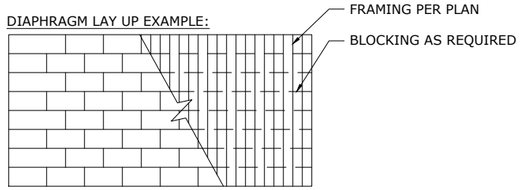
MANUFACTURED ROOF TRUSSES NOTES:

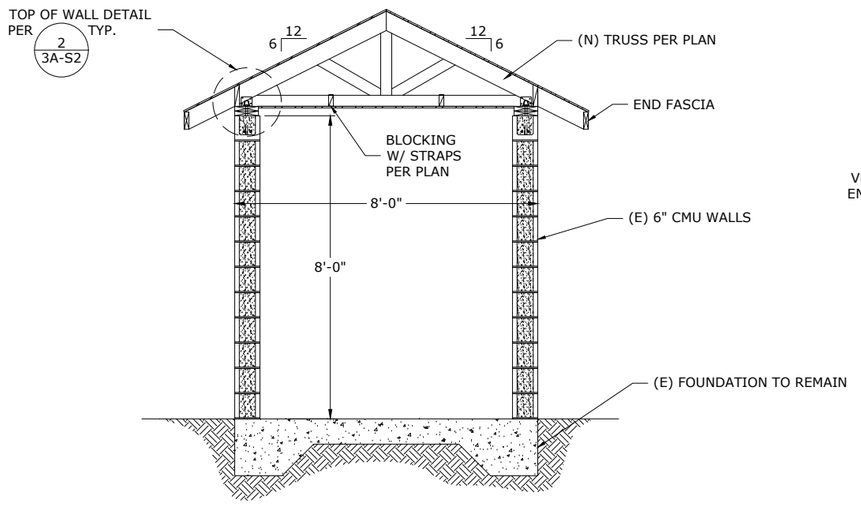
1. MANUFACTURED ROOF TRUSSES SHALL BE AT 24" CENTERS AND SHALL HAVE A MINIMUM OF A 2x6 TOP CHORDS FOR WOOD TRUSSES.
2. TRUSS MANUFACTURER TO COORDINATE TRUSSES WITH MECHANICAL DRAWINGS FOR LOUVER, DUCTS, AND OTHER PENETRATIONS.
3. STRUCTURAL CALCULATIONS SHALL BE SEALED BY AN OREGON LICENSED PROFESSIONAL ENGINEER AND SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO FABRICATION. ROOF TRUSSES SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA:
   - 3.1. DISTRIBUTED DEAD LOAD = 10 PSF (TOP CHORD), 5 PSF (BOT CHORD)
   - 3.3. DISTRIBUTED LIVE LOAD = 20 PSF (BOT CHORD)
   - 3.4. DISTRIBUTED ROOF LIVE LOAD = 20 PSF (TOP CHORD)
   - 3.5. DISTRIBUTED SNOW LOAD = 77 PSF
   - 3.6. EQUIPMENT POINT LOAD = 500 LB (AT WORST CASE LOCATION)
   - 3.7. AXIAL WIND LOAD IN TOP CHORD = 275 LB (ULTIMATE)
   - 3.8. AXIAL SEISMIC LOAD IN TOP CHORD = 150 LB (ULTIMATE)
   - 3.9. GABLE END TRUSS TO BE DESIGNED FOR ADDITIONAL ±200 PLF (ULTIMATE) WIND LOAD APPLIED ALONG TOP CHORD OF TRUSS FROM OUTRIGGER.
4. MANUFACTURER SHALL PROVIDE BRACING, BLOCKING, HOLDOWNS, AND ALL ACCESSORIES REQUIRED FOR PROPER INSTALLATION.
5. SHOP DRAWINGS SHALL PROVIDE PLACING AND ERECTION DIRECTION TO INSTALLER. CALCULATIONS AND SHOP DRAWINGS SHALL USE COMMON IDENTIFYING MARKS TO FACILITATE SHOP DRAWING REVIEW.

DIAPHRAGM NOTES:

1. FIELD NAILING TO BE AT 12" O.C.
2. SHEATHING TO BE SUPPORTED BY FRAMING 24" O.C. MAX.
3. NAILS TO BE COMMON OR GALVANIZED BOX NAILS. GALVANIZED NAILS SHALL BE HOT DIPPED OR TUMBLED. NAILS TO BE 3/8" FROM PANEL EDGE.
4. PANELS TO BE PLACED PER LAY UP EXAMPLE BELOW.

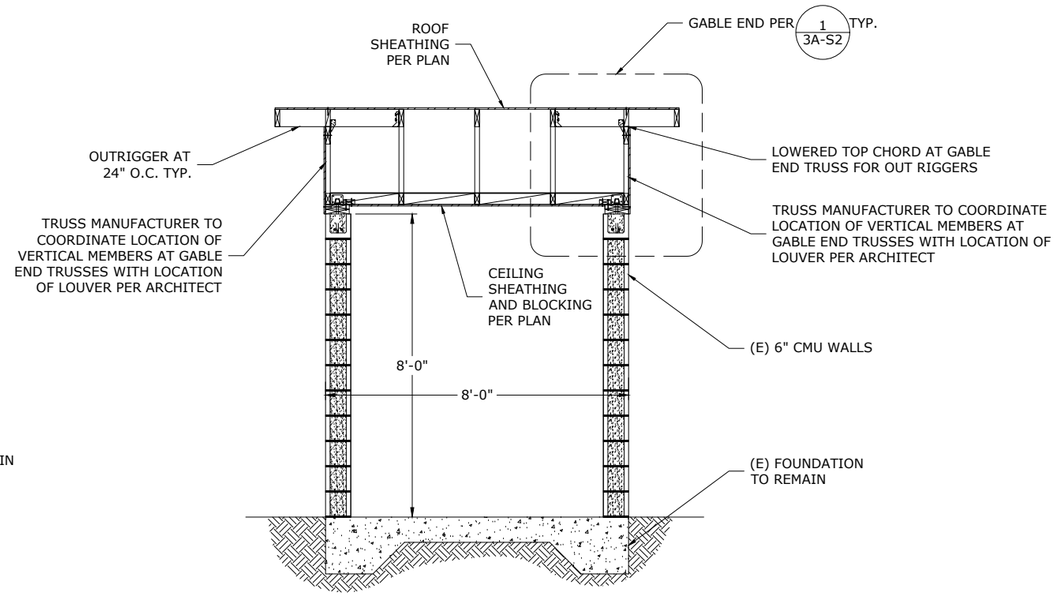
DIAPHRAGM LAY UP EXAMPLE:





SECTION (A / 3A-S1)

1/2" = 1'-0"



SECTION (B / 3A-S1)

1/2" = 1'-0"

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PSE PETERSON STRUCTURAL ENGINEERS

NO.	DATE	REVISION	BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3A-S1 31 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2012 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 — 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
ROOF PLAN AND SECTION

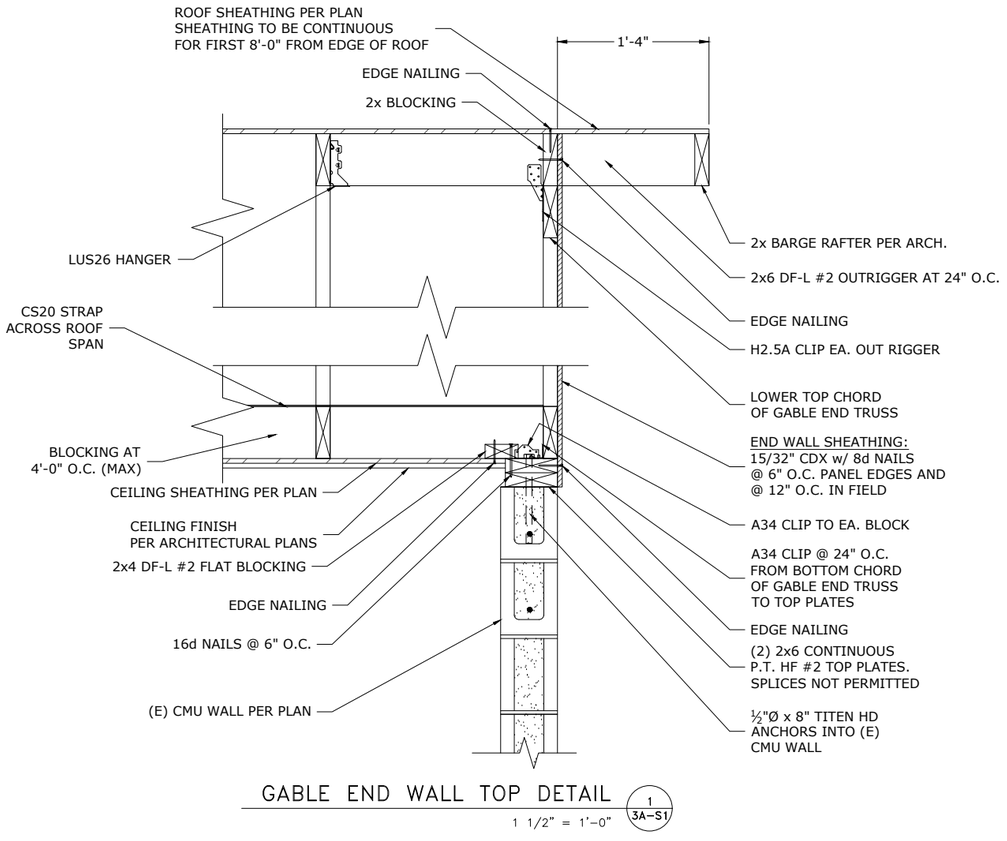
consor

DATE: MAY 2025

PROJECT: 19-2679

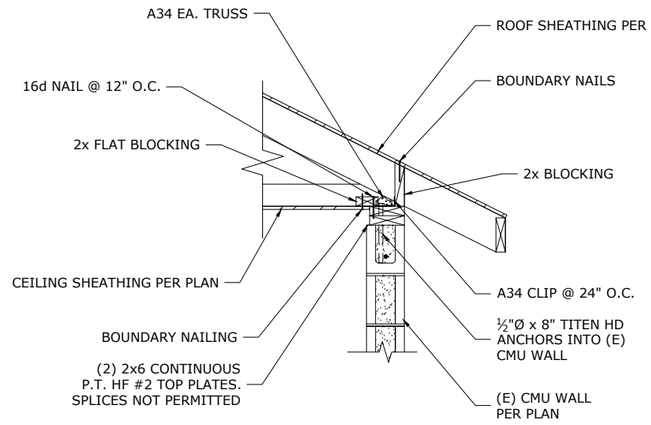
CLACKAMAS WATER ENVIRONMENT SERVICES

J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Group 3 Final Drawings R2 1901-0206.dwg 3A-S1 5/6/2025 2:11 PM SAMRICHMANN 24.2s (LMS Tech)



GABLE END WALL TOP DETAIL (1 / 3A-S1)

1 1/2" = 1'-0"



EXTERIOR WALL TOP DETAIL (2 / 3A-S1)

1" = 1'-0"

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PSE
PETERSON STRUCTURAL ENGINEERS

NO.	DATE	REVISION	BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3A-S2 32 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2021 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE 0 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
ROOF FRAMING DETAILS

consor

DATE: MAY 2025

PROJECT: 19-2679

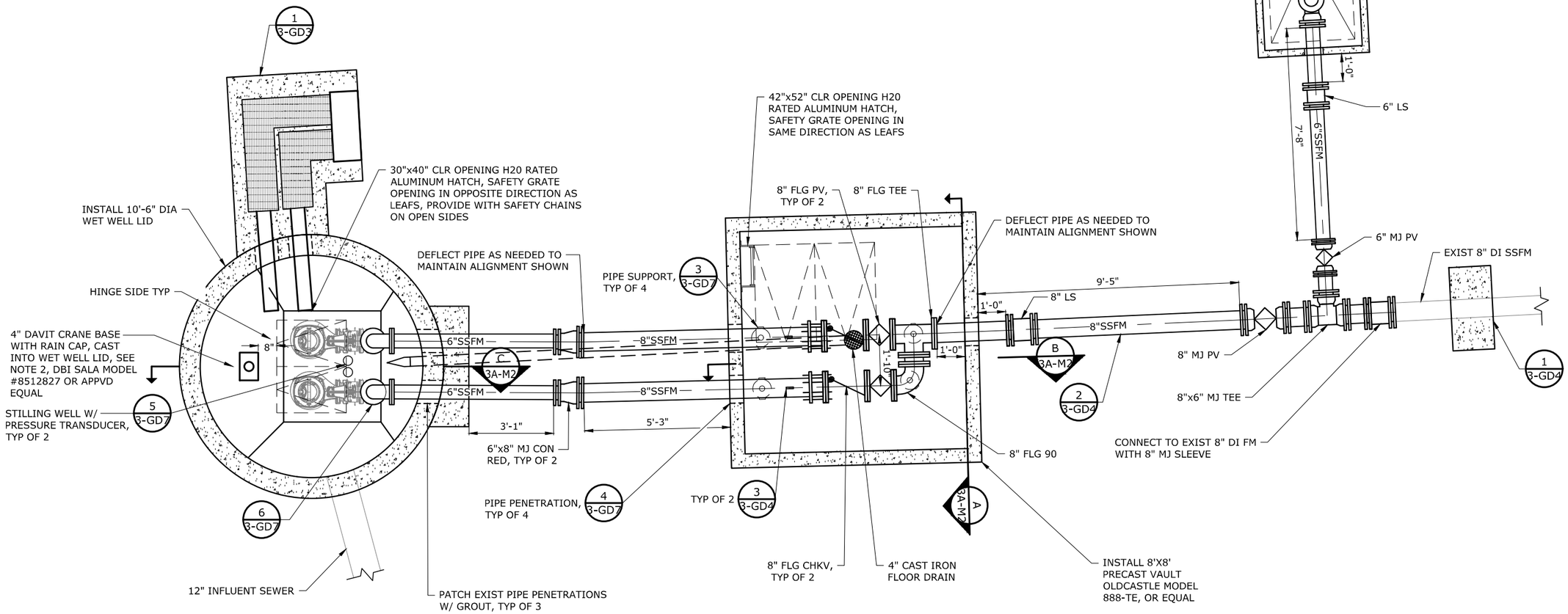
CLACKAMAS WATER ENVIRONMENT SERVICES

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SHEET NOTE:

1. ALL PIPE TO BE MECHANICALLY RESTRAINED.

2. DAVIT CRANE LOCATION IS APPROXIMATE, CONTRACTOR TO COORDINATE WET WELL LID REINFORCEMENT TO PROVIDE ADEQUATE SUPPORT FOR DAVIT CRANE.



PLAN
SCALE: 1/2"=1'-0"

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-M1 33 of 184

OREGON PROFESSIONAL ENGINEER 98172 Nicholas Scott Laferriz Date: 12/31/2026
OREGON PROFESSIONAL ENGINEER 98172 Nicholas S. Laferriz
RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
WET WELL AND VAULT PLAN

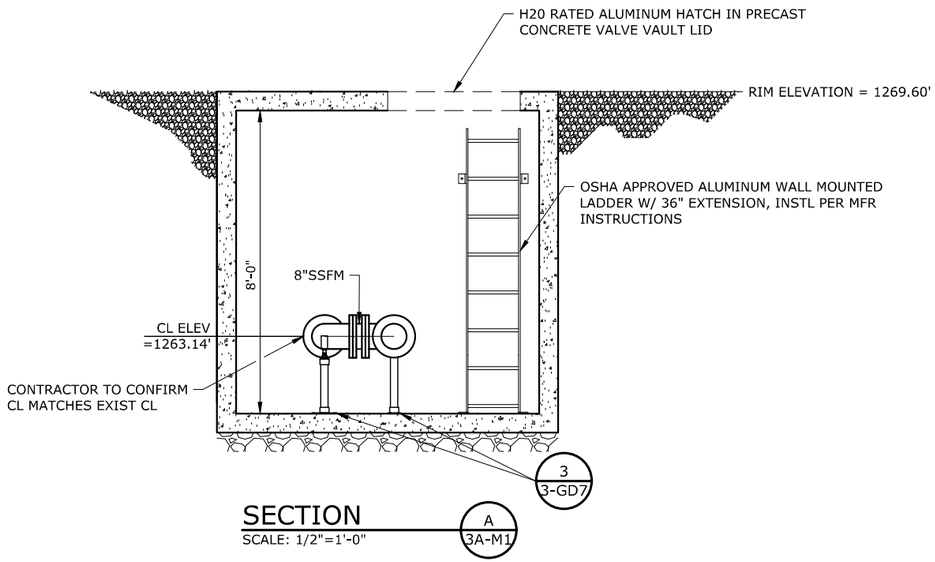
consor

DATE: MAY 2025

PROJECT: 19-2679

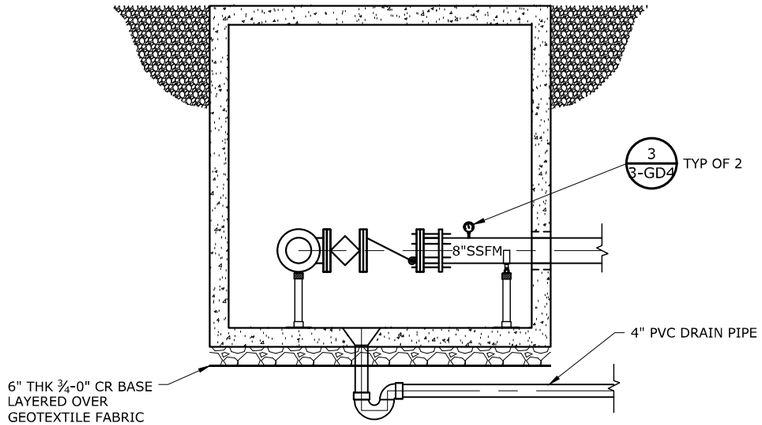
CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH A-M.dwg 3A-M1 4/28/2025 4:05 PM NICK.MCFADDIN 24.1s (LMS Tech)



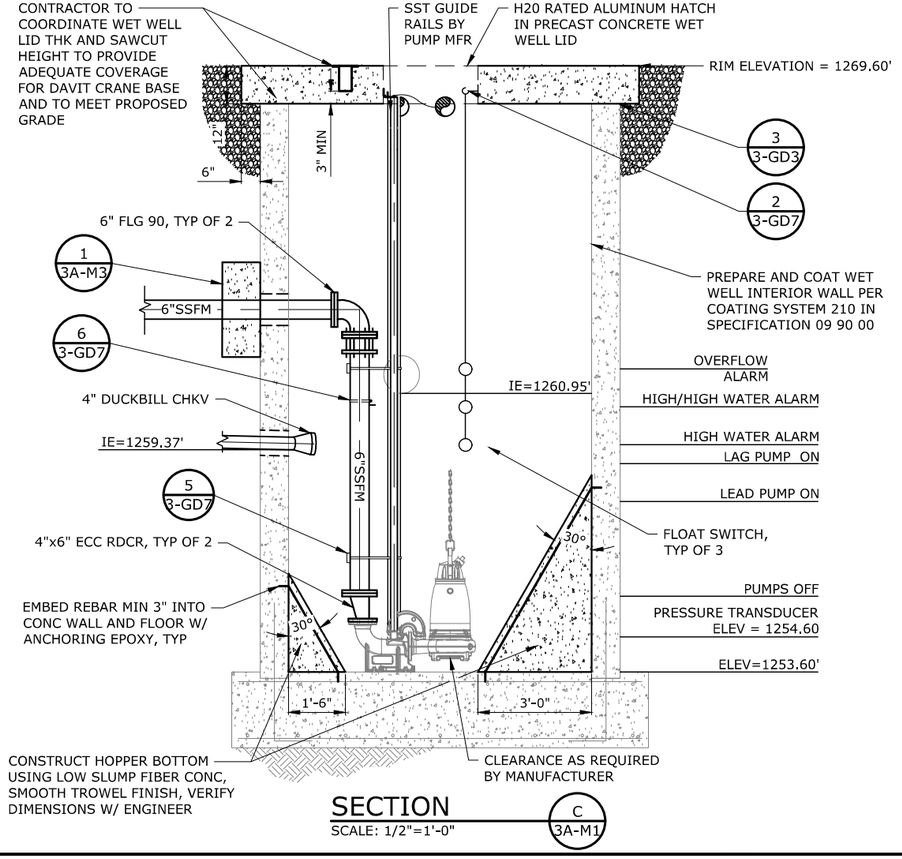
SECTION
SCALE: 1/2"=1'-0"

A
3A-M1



SECTION
SCALE: 1/2"=1'-0"

B
3A-M1



SECTION
SCALE: 1/2"=1'-0"

C
3A-M1

PRIMARY LEVEL CONTROL (PRESSURE TRANSDUCERS)	
CONTROL LOGIC	ELEVATION
LAG PUMP ON	1259.00'
LEAD PUMP ON	1258.00'
PUMPS OFF	1255.60'

BACKUP LEVEL CONTROL (FLOATS)		
CONTROL LOGIC	PUMP HARDWIRED TO	ELEVATION
HIGH WATER ALARM	PUMP 1	1259.60'
HIGH/HIGH WATER ALARM	PUMP 2	1260.60'
OVERFLOW ALARM	NONE	1261.60'

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH A-M.dwg 3A-M2 4/28/2025 4:05 PM NICK.MCFADDIN 24.1s (LMS Tech)

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-M2
34 of 184

OREGON REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas S. Laferriz RENEWS 12-31-26

OREGON REGISTERED LICENSED LANDSCAPE ARCHITECT 2000000 NICHOLAS S. LAFERRIZ RENEWS 12-31-26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

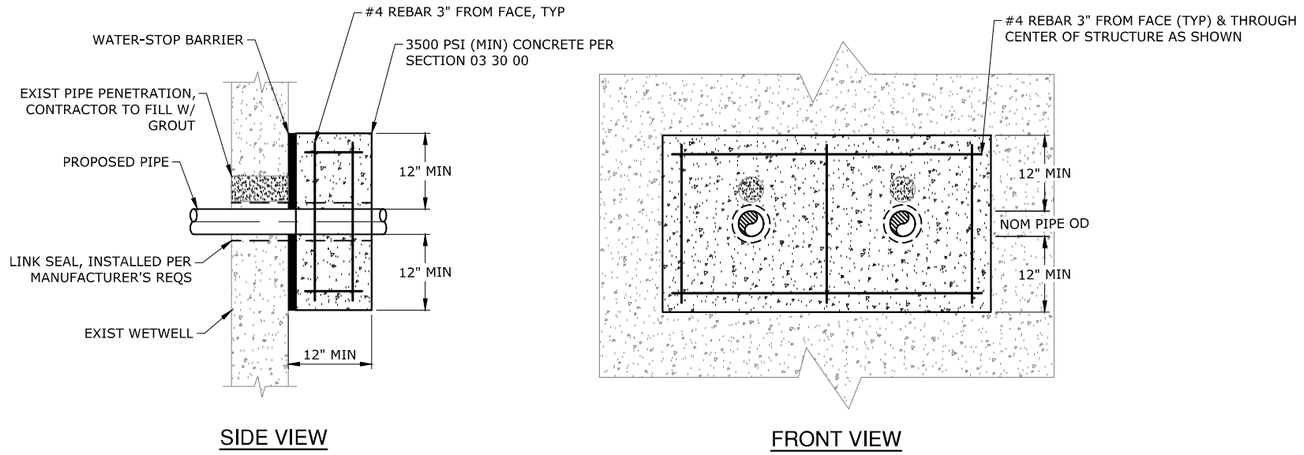
SOUTH WELCHES PUMP STATION
WET WELL AND VAULT SECTIONS

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES



SIDE VIEW

FRONT VIEW

CONCRETE FORCE MAIN OUTLET REINFORCEMENT DETAIL

SCALE: NTS

1
3A-M2

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 9, 2013
Nicholas S. Lafrenz
Date:
RENEWS 12-31-26

SHEET
3A-M3
35 of 184

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
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1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

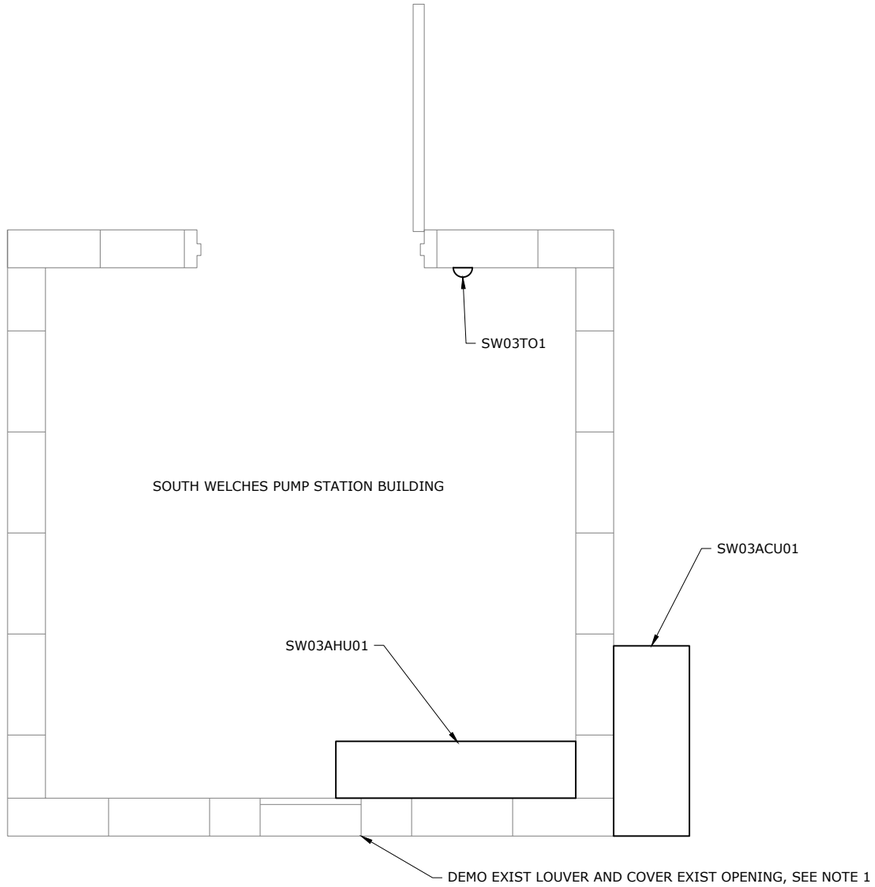
SOUTH WELCHES PUMP STATION
MECHANICAL DETAILS

CLACKAMAS WATER ENVIRONMENT SERVICES

consor

PROJECT: 19-2679 | DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH A-M.dwg 3A-M3 4/28/2025 4:05 PM NICK.MCFADDIN 24.1s (LMS Tech)



N

PLAN
SCALE: 1"=1'

SHEET NOTES:

1. CONTRACTOR TO VERIFY ALL HVAC EQUIPMENT MOUNTING LOCATIONS IN FIELD WITH ENGINEER.

2. CONTRACTOR TO COORDINATE LOCATION OF WALL-MOUNTED UNITS (SW03AHU01, SW03ACU01, SW03T01) WITH EXISTING ELECTRICAL AND PLUMBING.

3. LOCATE ALL CONTROLS, PANELS, AND DISCONNECT SWITCHES APPROXIMATELY 4 FEET ABOVE FINISHED FLOOR. COORDINATE LOCATIONS WITH ELECTRICAL.

4. EQUIPMENT MANUFACTURERS AND MODEL NUMBERS ARE PROVIDED FOR REFERENCE ONLY AND SHALL BE USED TO ESTABLISH EQUIPMENT SIZES AND REQUIRED PERFORMANCE. APPROVED EQUAL MANUFACTURERS WILL BE ACCEPTED.

NOTES:

1. REMOVE AND DISPOSE OF EXISTING LOUVER. FILL WALL OPENING WITH RIGID FOAM INSULATION CUT TO FIT, COVER WALL OPENING WITH 20 GAUGE SHEET METAL AND FASTEN SHEETS TO WALL USING $\frac{1}{2}$" DIA SIMPSON TITEN HD ANCHORS.

SPLIT SYSTEM HEAT PUMP

TAG NO.	LOCATION	COOLING UNIT TOTAL CAPACITY (BTUH)	HEATING UNIT TOTAL CAPACITY (BTUH)	CONTROL	VOLTS/ PHASE	MANUFACTURER & MODEL
SW03AHU01	ELEC/CTRL ROOM	17,000	18,000	SW03T01	208-230 / 1	MRCOOL, EZPRO-18-HP-23016D-0
SW03ACU01	OUTSIDE	17,000	18,000	SW03T01		

THERMOSTATS

TAG NO.	LOCATION	TYPE	TEMPERATURE RANGE	MANUFACTURER & MODEL
SW03T01	ELECTRICAL/CONTROL ROOM	WIRELESS REMOTE	32°F-104°F	MRCOOL, RG10A(D2S)/BGEFU1

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3A-H1 36 of 184

REGISTERED PROFESSIONAL ENGINEER 79401 OREGON JUNE 11, 1982 ALEX M. BARGNESS RENEWS 12-31-25

SCALE | VERT: AS SHOWN | HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
ELECTRICAL ROOM HVAC
PLAN AND SCHEDULES

consor

DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679

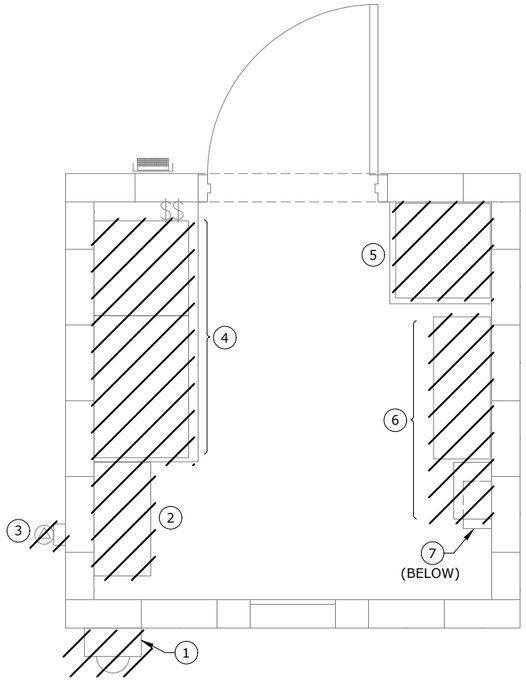
G:\PDX_Projects\19\2679 - Clackamas County - WES - Pump Station Rehabilitation and Upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH A-H.dwg 3A-H1 5/9/2025 1:19 PM JACOB.COLES 24.1s (LMS Tech)

GENERAL NOTES

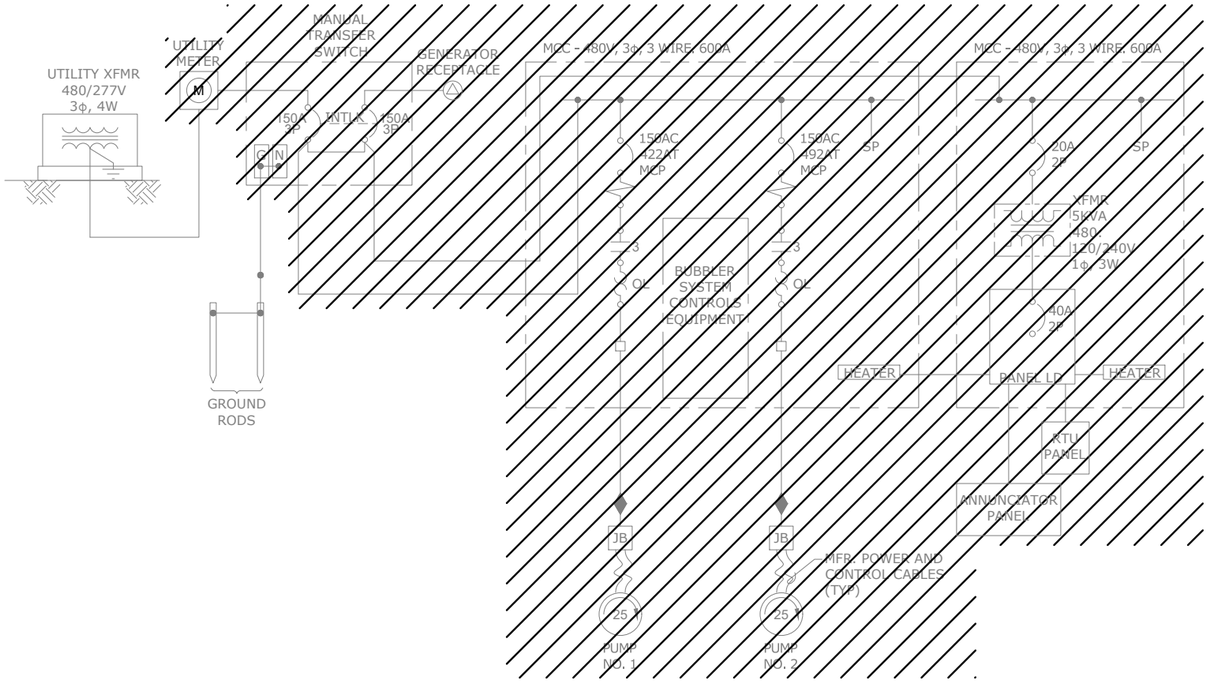
1. CONTRACTOR TO COORDINATE WITH OWNER TO SALVAGE COMPONENTS BEFORE DEMOLITION OCCURS.

KEY NOTES

1. EXISTING UTILITY METER TO BE REPLACED WITH NEW METERBASE W/ MAIN BREAKER. REMOVE EXISTING CONDUIT TO MANUAL TRANSFER SWITCH AND GROUT IN PENETRATION.
2. EXISTING MANUAL TRANSFER SWITCH TO BE DEMO'D. REMOVE EXISTING CONDUIT AND CONDUCTORS. SEE DETAIL 1.
3. EXISTING GENERATOR RECEPTACLE TO BE DEMO'D. REMOVE EXISTING CONDUIT AND CONDUCTORS.
4. EXISTING MCC WITH MOTOR STARTING AND BUBBLER CONTROL EQUIPMENT TO BE DEMO'D. REMOVE EXISTING CONDUIT AND CONDUCTORS. SEE DETAIL 2.
5. EXISTING MCC SECTION WITH TRANSFORMER AND PANELBOARD TO BE DEMO'D. REMOVE EXISTING CONDUIT AND CONDUCTORS. SEE DETAIL 3.
6. EXISTING ANNUNCIATOR AND RELAY PANELS TO BE DEMO'D. SEE DETAIL 4.
7. EXISTING RADIO AND RTU PANEL EQUIPMENT TO BE SALVAGED AND RE-USED IN NEW RTU PANEL. SEE IC SHEETS FOR ADDITIONAL INFORMATION. SEE DETAIL 4.



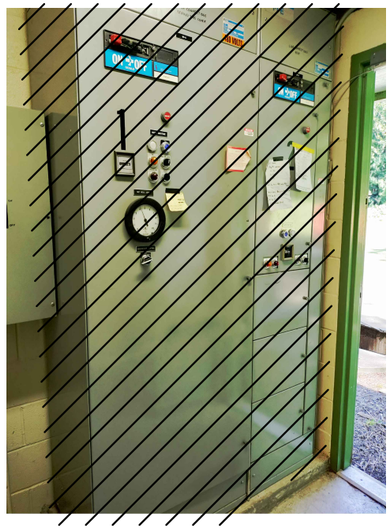
ELECTRICAL DEMO PLAN
SCALE: 3/4"= 1'



ONE-LINE DIAGRAM - DEMO
SCALE: NTS



TRANSFER SWITCH ELEV. 1
SCALE: NONE



MCC NORTH ELEV. 2
SCALE: NONE



MCC SOUTH ELEV. 3
SCALE: NONE



ANNUNCIATOR ELEV. 4
SCALE: NONE

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OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

SHEET 3A-E1
37 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2004 MICHAEL E. WALLIS
EXPIRES: 6/30/26

SCALE: VERT.: AS SHOWN HORIZ: AS SHOWN
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
ELECTRICAL
DEMOLITION PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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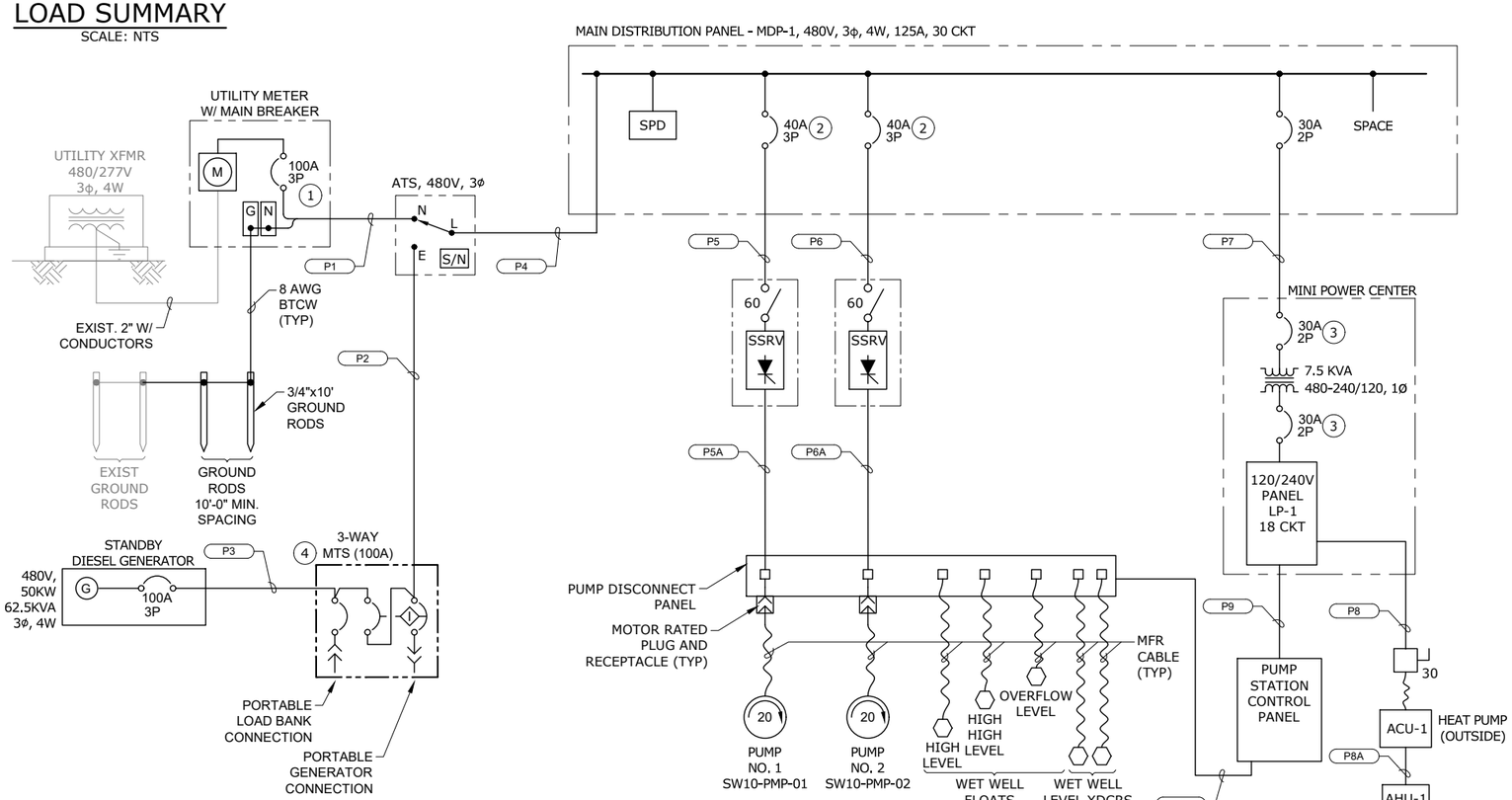
LOAD SUMMARY		LOAD		
QTY.	DESCRIPTION	HP	KVA	AMPS @ 480 VAC
	MOTOR LOADS			
1	PUMP #1	20.0	22.4 KVA	27.0 Amps
1	PUMP #2	20.0	22.4 KVA	27.0 Amps
	OTHER LOADS			
1	DISTRIBUTION XFMR * MISC 120V LOADS (PART OF XFMR ABOVE) * - AMP LOAD FOR XFMR IS 1-PHASE		7.5 KVA	15.6 Amps
	SUBTOTAL		**52.4**	**69.6**
	LARGEST MOTOR X 25% NON-MOTOR LOADS X 25%		5.6 KVA 1.9 KVA	6.7 Amps 2.3 Amps
	TOTAL		**59.9 KVA**	**78.6 Amps**

KEY NOTES

1. PROVIDE WARNING SIGN READING "UTILITY SERVICE DISCONNECT DOES NOT DISCONNECT GENERATOR".
2. VERIFY SIZE WITH MANUFACTURER OF SOFT STARTER PROVIDED.
3. SIZE AS DETERMINED BY TRANSFORMER MANUFACTURER.
4. 3-WAY MANUAL TRANSFER SWITCH WITH CAM-LOCK CONNECTORS.

LOAD SUMMARY

SCALE: NTS



ONE-LINE DIAGRAM - MODIFIED

SCALE: NTS

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AK #1018436
PROJECT#: 20.18.02

NO. | DATE | REVISION | BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

REGISTERED PROFESSIONAL ENGINEER OREGON MAY 14, 2019 88305PE MICHAEL E. WELLS
EXPIRES: 6/30/26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

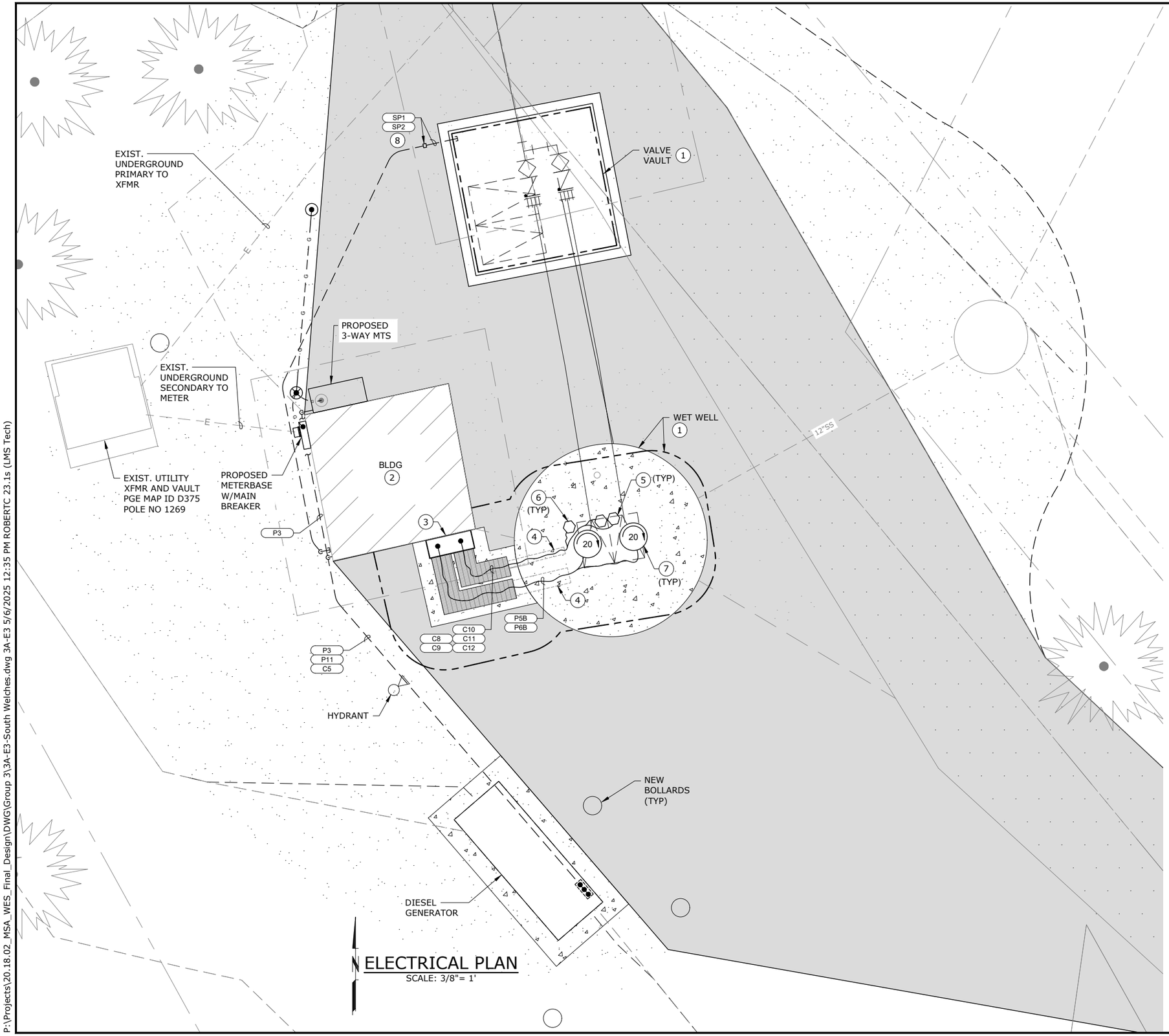
SOUTH WELCHES PUMP STATION
ELECTRICAL
ONE-LINE DIAGRAM

SHEET 3A-E2
38 of 184

consor
DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES
PROJECT: 19-2679

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GENERAL NOTES

1. SEE SHEET 3A-E5 FOR CONDUIT AND CIRCUIT SCHEDULE.
2. VERIFY ALL UNDERGROUND CONDUITS. CONDUIT LOCATIONS SHOWN ARE FROM RECORD AS-BUILTS AND HAVE NOT BEEN VERIFIED FOR ACCURACY.
3. CONTRACTOR TO PAY SPECIAL ATTENTION TO EXISTING UNDERGROUND PRIMARY UTILITY POWER ROUTING WHEN INSTALLING NEW VALVE VAULT AND DURING FORCE MAIN EXCAVATIONS.
4. SEE SHEET 3-GD6 FOR TYPICAL CONDUIT TRENCHES AND TRANSITION AND GROUND TEST.

KEY NOTES

(1) CLASS 1 DIV. 2 GROUP D SPACE IN AN ENVELOPE 18" ABOVE GRADE 3' LATERALLY FROM TRENCH AND SLEEVE OPENINGS FOR WET WELL AND CLASS 1 DIV. 2 GROUP D SPACE INSIDE OF VALVE VAULT. INTERIOR OF WET WELL IS CLASS 1 DIV. 1 GROUP D SPACE

(2) SEE SHEET 3A-E4 FOR BUILDING ELECTRICAL EQUIPMENT CONNECTION PLAN.

(3) PUMP DISCONNECT PANEL WITH PUMP RECEPTACLES AND PLUGS. SEE SHEET 3A-E8.

(4) PUMP CABLING TRENCH WITH PIPE SLEEVE FOR ROUTING OF PUMP AND LEVEL CONTROLS MANUFACTURER'S CABLES. SEE SHEETS 3A-M1 AND 3A-M2.

(5) WET WELL LEVEL SENSORS, PT-1001 & PT-1002 IN STILLING WELLS. SEE SHEETS 3A-M1, 3A-M2 AND 3-GD6 FOR LOCATION AND INSTALLATION INFORMATION.

(6) FLOAT SWITCHES, LSH-1010, LSHH-1010, LSHH-1011 IN WET WELL. SEE SHEET 3A-M1, 3A-M2 AND 3-GD6 FOR LOCATION AND INSTALLATION INFORMATION.

(7) SUBMERSIBLE PUMPS WITH MFR CABLING ROUTED TO PUMP DISCONNECT PANEL VIA CABLE TRENCH AND SLEEVES.

(8) CONDUITS ARE ENTERING HAZARDOUS AREA; PROVIDE TRANSITION 12" OUTSIDE VAULT FROM PVC TO RGS TO MAINTAIN CONTINUOUS CONDUITS TO FUTURE SEAL OFFS. SEAL AND CAP FOR FUTURE INTERIOR TO VAULT AND OUTSIDE BUILDING WALL.

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NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
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APPROVED: MEW

SHEET 3A-E3 39 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2010 MICHAEL E. NEW
EXPIRES: 6/30/26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN
NOTICE IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE 0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
ELECTRICAL
SITE PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

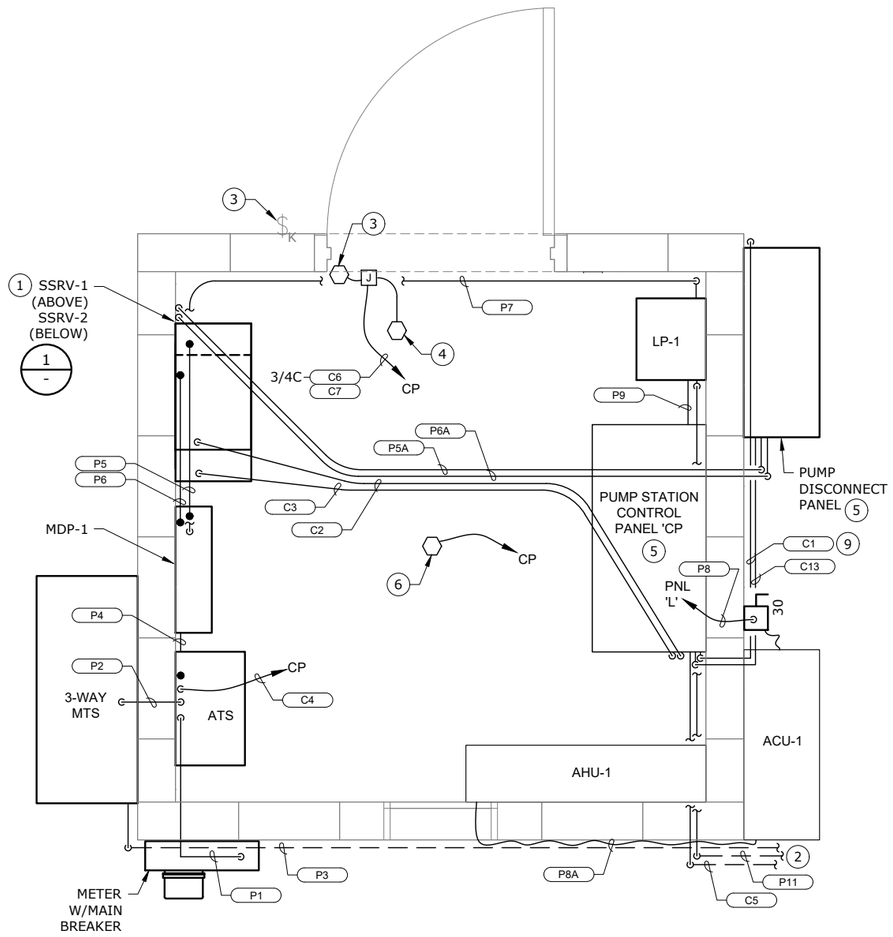
P:\Projects\20.18.02_MSA_WES_Final_Design\DWG\Group 3\3A-E3-South Welches.dwg 3A-E3 5/6/2025 12:35 PM ROBERTC 23.1s (LMS Tech)

KEY NOTES

1. SOFT STARTER PANELS. SEE SHEETS 3A-E6 & 3A-E7.
2. SEE SHEET 3A-E3 FOR CONTINUATION.
3. EXISTING INTRUSION SWITCH TO BE REPLACED WITH NEW AND CONNECTED TO NEW CONTROL PANEL. REMOVE EXISTING KEYSWITCH AND WIRING FROM INTRUSION BYPASS CIRCUIT AND INSTALL BLANK STAINLESS STEEL COVER PLATE.
4. CEILING MOUNT NEW SMOKE DETECTOR AND CONNECT TO NEW CONTROL PANEL.
5. CONDUIT ENTRIES TO BE FROM SIDE OF PANEL. NO TOP ENTRIES.
6. RE-CONNECT EXISTING CABLING FROM RADIO ANTENNA LOCATED ON ROOFTOP TO RELOCATED EQUIPMENT IN CONTROL PANEL. ENSURE ANTENNA INSTALLATION IS RE-INSTALLED AT SAME HEIGHT AS EXISTING AND PROVIDE NEW COAX CABLING IF NEEDED.
7. EXISTING LUMINAIRES TO BE RE-USED AND RECONNECTED.
8. REPLACE EXISTING IN-WALL RECEPTACLE WITH GFCI UNIT AND CONNECT TO LP-1 USING EXISTING IN-SLAB AND WALL CONDUIT. EXTEND CONDUIT AS NEEDED.
9. CONDUIT CONTAINS INTRINSICALLY SAFE CONDUCTORS. ENSURE SEPARATION OF CONDUCTORS FROM NON INTRINSICALLY SAFE CONDUCTORS PER NEC AND ENTER PANEL IN INTRINSIC SAFE DESIGNATED AREA.

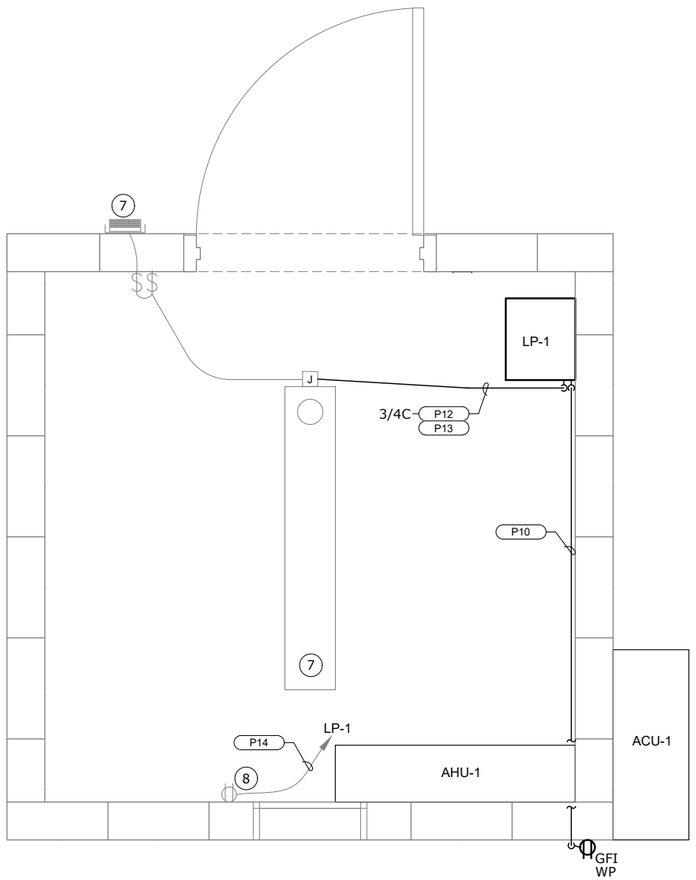
GENERAL NOTES

1. SEE IC SHEETS FOR ADDITIONAL CONNECTION INFORMATION.
2. SEE SHEET 3A-E5 FOR CONDUIT AND CIRCUIT SCHEDULE.
3. SEAL ALL CONDUIT PENETRATIONS, WATER-PROOF, FROM EXTERIOR TO INTERIOR OF BUILDING WITH NON-SHRINK GROUT.
4. OFFSET EQUIPMENT FROM WALL WITH STRUT TO MAINTAIN WORKING CLEARANCE WHEN NECESSARY (IE PANEL LP-1)
5. PURSUANT TO OCEC SECTION 9.4.1.1 EXCEPTION (H), THE INTERIOR LIGHTING IS EXEMPT FROM AUTOMATED LIGHTING CONTROLS TO ENSURE SAFETY OF OPERATIONS PERSONNEL.



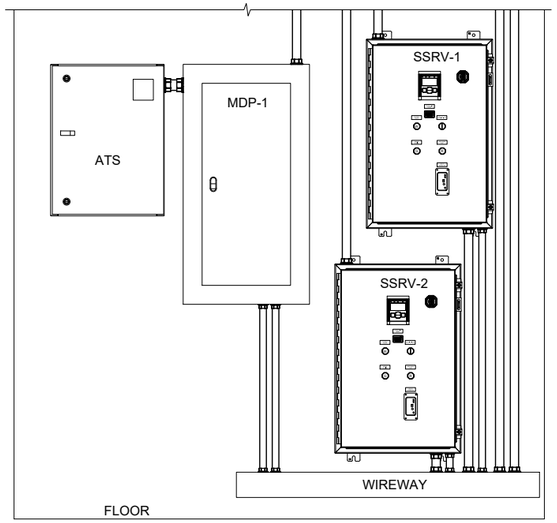
ELECTRICAL BUILDING PLAN

SCALE: 1"= 1'



ELECTRICAL LIGHTING & RECEPT PLAN

SCALE: 1"= 1'



SSRV ELEV. DETAIL

1 / -

SCALE: 1" = 1'-0"

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PROJECT#: 20.18.02

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APPROVED: MEW

SHEET 3A-E4 40 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON MAY 14, 2004 MICHAEL E. WELLS 88305PE EXPIRES: 6/30/26

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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
ELECTRICAL
BUILDING PLAN

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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ALL CIRCUITS ARE IDENTIFIED ON THE PLANS WITH THE DIAMOND SYMBOL. CONDUCTOR SIZES ARE BASED ON COPPER CONDUCTORS. CONDUIT SIZES ARE SHOWN FOR CASES WHEN CIRCUIT CONDUCTORS ARE RUN WITHOUT OTHER CIRCUITS. MULTIPLE CIRCUITS RUN IN COMMON CONDUITS ARE SHOWN ON PLANS AND SUPERSEDE THE BASIC CONDUIT SIZE SHOWN.

RACEWAY SIZES ARE IN INCHES WITH QUANTITIES IN EXCESS OF (1) SHOWN IN ADJACENT PARENTHESIS. CONDUCTOR CONFIGURATIONS ARE CODED AS FOLLOWS: P- FOR POWER CONDUCTORS, G - FOR GROUND CONDUCTORS, N - FOR NEUTRAL CONDUCTORS, C - FOR CONTROL CONDUCTORS, TSP - FOR TWISTED SHIELDED PAIR, AND SP - FOR SPARE CONDUCTORS.

CIRCUITS REVISED SINCE LAST ISSUE ARE INDICATED BY AN ASTERISK(*).

CIRCUIT NUMBER	FROM	TO	CONDUCTORS	RACEWAY	NOTES
P1	METERBASE W/ MAIN BREAKER	AUTOMATIC TRANSFER SWITCH (ATS)	(3) 2 AWG, P (1) 2 AWG, N (1) 8 AWG, G	1.25	
P2	ATS	3-WAY MANUAL TRANSFER SWITCH (MTS)	(3) 2 AWG, P (1) 2 AWG, N (1) 8 AWG, G	1.25	
P3	3-WAY MTS	GENERATOR	(3) 2 AWG, P (1) 2 AWG, N (1) 8 AWG, G	1.25	
P4	ATS	MDP-1	(3) 2 AWG, P (1) 2 AWG, N (1) 8 AWG, G	1.25	
P5	MDP-1	SSRV 1 CONTROL PANEL	(3) 8 AWG, P (1) 10 AWG, G	3/4	
P5A	SSRV 1 CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(3) 8 AWG, P (1) 18 AWG, TSP (1) 10 AWG, G	1	PUMP 1 POWER PUMP THERMAL/LEAK CKT
P5B	PUMP DISCONNECT PANEL (PDP)	PUMP 1	MFR CABLE	TRENCH	
P6	MDP-1	SSRV 2 CONTROL PANEL	(3) 8 AWG, P (1) 10 AWG, G	3/4	
P6A	SSRV 2 CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(3) 8 AWG, P (1) 18 AWG, TSP (1) 10 AWG, G	1	PUMP 2 POWER PUMP THERMAL/LEAK CKT
P6B	PUMP DISCONNECT PANEL (PDP)	PUMP 2	MFR CABLE	TRENCH	
P7	MDP-1	LP-1 POWER PANEL W/ TRANSFORMER	(2) 10 AWG, P (1) 8 AWG, G	3/4	
P8	LP-1	AIR CONDENSER UNIT ACU-1	(2) 12 AWG, P (1) 12 AWG, G	3/4	ROUTE VIA DISCONNECT SWITCH
P8A	AIR CONDENSER UNIT ACU-1	AIR HANDLING UNIT AHU-1	MFR CABLING		ROUTED WITH HVAC LINESET
P9	LP-1	PUMP STATION CONTROL PANEL	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
P10	LP-1	EXTERIOR RECEPTACLE	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
P11	LP-1	GENERATOR	(2) 12 AWG, P (2) 12 AWG, N (1) 12 AWG, G	3/4	BLOCK HTR / BATTERY CHGR CKT
P12	LP-1	EXISTING SWITCHES FOR EXTERIOR LUMINAIRE	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	VIA EXISTING LUMAIRE/CONDUIT
P13	LP-1	EXISTING SWITCHES FOR INTERIOR LUMINIARE	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
P14	LP-1	EXISTING INTERIOR RECEPTACLE	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	VIA EXISTING IN-SLAB/WALL CONDUIT EXTEND CONDUIT AS NEEDED
C1	PUMP STATION CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(2) 18 AWG, TSP (6) 14 AWG, C (1) 14 AWG, G	1	NEW LEVEL SENSOR CABLES LO, HI, & HI-HI FLOATS (INSTRINSIC SAFE - KEEP SEPARATE)
C2	PUMP STATION CONTROL PANEL	SSRV 1 CONTROL PANEL	(14) #14 AWG, C (1) #14 AWG, G (2) #14 AWG, SP	1	PUMP 1 CONTROL
C3	PUMP STATION CONTROL PANEL	SSRV 2 CONTROL PANEL	(14) #14 AWG, C (1) #14 AWG, G (2) #14 AWG, SP	1	PUMP 2 CONTROL
C4	PUMP STATION CONTROL PANEL	ATS	(4) 14 AWG, C (1) 14 AWG, G (2) 14 AWG, SP	3/4	ATS POS SIGNALS
C5	PUMP STATION CONTROL PANEL	GENERATOR	(4) 14 AWG, C (1) 14 AWG, G (2) 14 AWG, SP	1	RUN & FAULT SIGNALS
C6	PUMP STATION CONTROL PANEL	INTRUSION SWITCH	(2) 14 AWG, C (1) 14 AWG, G	3/4	
C7	PUMP STATION CONTROL PANEL	SMOKE DETECTOR	(2) 14 AWG, C (2) 14 AWG, C	3/4	DC POWER SIGNAL CKT
C8	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL SENSOR 1	MFR CABLE	TRENCH	
C9	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL SENSOR 2	MFR CABLE	TRENCH	
C10	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL HIGH FLOAT	MFR CABLE	TRENCH	
C11	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL HIGH HIGH FLOAT	MFR CABLE	TRENCH	
C12	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL OVERFLOW FLOAT	MFR CABLE	TRENCH	
C13	PUMP STATION CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4"	
SP1	VALVE VAULT	SOUTH OF BUILDING	PULL CORD	1	STUB AND CAP
SP2	VALVE VAULT	SOUTH OF BUILDING	PULL CORD	1	STUB AND CAP

CIRCUIT SCHEDULE
SCALE: NTS

PANEL: MDP-1	VOLTAGE: 480 3Φ 4W	MOUNTING: SURFACE
LOCATION: ELECTRICAL ROOM	BUS: 125A COPPER	AIC: 65,000
FEEDER:ATS	MAIN:	

CKT NO	CIRCUIT DESCRIPTION	BREAKER POLES	BREAKER AMPS	VA	PHASE	LOAD VA	BREAKER POLES	BREAKER AMPS	CIRCUIT DESCRIPTION	CKT NO
1	SOLID STATE REDUCED VOLTAGE STARTER 1 SSRV-1	3	30	7750.4	A	2790	2	30	MINI POWER CENTER WITH 18CKT LIGHTING PANEL	2
3	"	-	30	7750.4	B	2855	-	30	"	4
5	"	-	30	7750.4	C	-	-	-	SPACE	6
7	SOLID STATE REDUCED VOLTAGE STARTER 2 SSRV-2	3	125	7750.4	A	-	-	-	SPACE	8
9	"	-	125	7750.4	B	-	-	-	SPACE	10
11	"	-	125	7750.4	C	-	-	-	SPACE	12
13	SPARE	3	20	-	A	-	-	-	SPACE	14
15	"	-	20	-	B	-	-	-	SPACE	16
17	"	-	20	-	C	-	-	-	SPACE	18
19	SPACE	-	-	-	A	-	-	-	SPACE	20
21	SPACE	-	-	-	B	-	-	-	SPACE	22
23	SPACE	-	-	-	C	-	-	-	SPACE	24
25	SPACE	-	-	-	A	-	-	-	SPACE	26
27	SPACE	-	-	-	B	-	-	-	SPACE	28
29	SPACE	-	-	-	C	-	-	-	SPACE	30

LOAD PER PHASE

PHASE A	18.3	KVA
PHASE B	18.4	KVA
PHASE C	15.5	KVA

TOTAL LOAD	52.1	KVA

TOTAL AMPS	63	AMPS

PANEL: LP-1	VOLTAGE: 240 1Φ 3W	MOUNTING: SURFACE
LOCATION: ELECTRICAL ROOM	BUS: 100A COPPER	AIC: 10,000
FEEDER: MDP-1 SEE ONE-LINE	MAIN: 25A/PRI , 30A SEC W/ 5KVA XFMR	

CKT NO	CIRCUIT DESCRIPTION	BREAKER POLES	BREAKER AMPS	VA	PHASE	LOAD VA	BREAKER POLES	BREAKER AMPS	CIRCUIT DESCRIPTION	CKT NO
1	GENERATOR BLOCK HEATER	1	20	600	A	-	1	20	SPARE	2
3	BATTERY CHARGER	1	20	240	B	500	1	20	CONTROL PANEL	4
5	INTERIOR LIGHTING	1	20	150	A	180	1	20	INTERIOR RECEPTACLE	6
7	EXTERIOR LIGHTING	1	20	180	B	180	1	20	EXTERIOR RECEPTACLE	8
9	SPARE	1	20	-	A	1860	2	20	HVAC AIR CONDENSOR UNIT ACU-1	10
11	SPARE	1	20	-	B	1860	-	20	"	12
13	SPARE	1	20	-	A	-	1	20	SPARE	14
15	SPARE	1	20	-	B	-	1	20	SPARE	16
17	SPARE	1	20	-	A	-	1	20	SPARE	18

LOAD PER PHASE

PHASE A	2.8	KVA
PHASE B	3.0	KVA

TOTAL LOAD	5.8	KVA

TOTAL AMPS	24	AMPS

PANEL SCHEDULES
SCALE: NTS

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

SHEET 3A-E5 41 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2010 MICHAEL E. WEST
EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ.: AS SHOWN

NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
ELECTRICAL
CIRCUIT AND PANEL SCHEDULES

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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GENERAL NOTES

1. PANEL LAYOUT IS CONCEPTUAL AND FINALIZED LAYOUT SHALL BE PER UL 508 REQUIREMENTS AND PROVIDED BY MANUFACTURER.

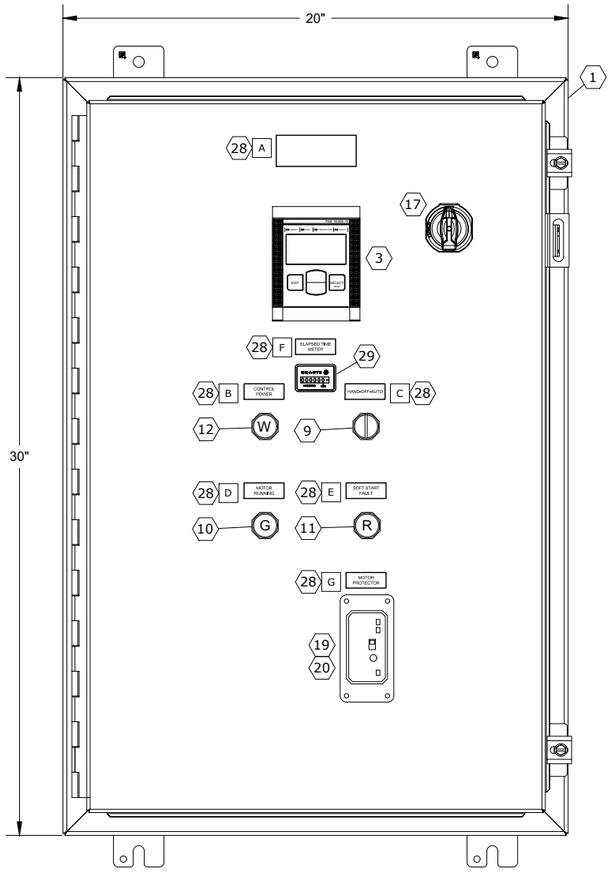
2. PANEL IS TYPICAL FOR 2 UNITS, SSRV-1 (SW10-PMP-01) AND SSRV-2 (SW10-PMP-02).

NAMEPLATE SCHEDULE

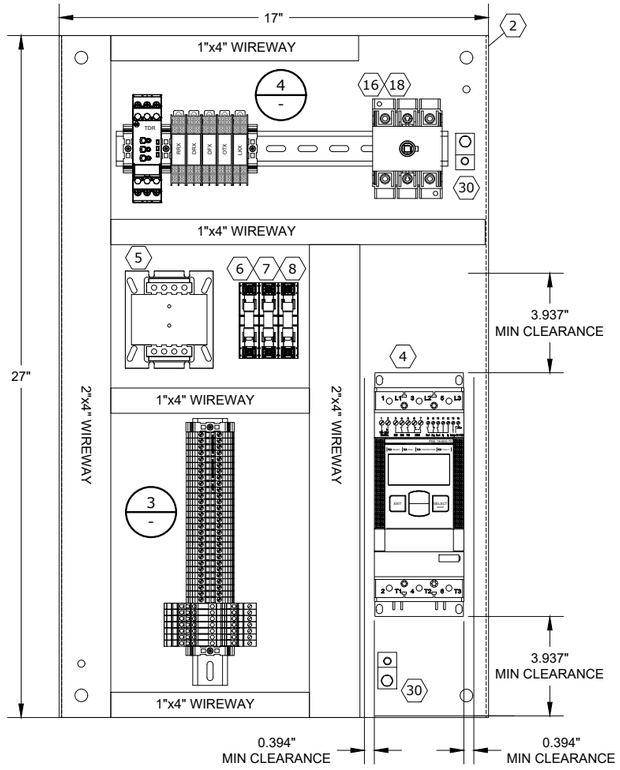
A	ITEM	NAMEPLATE SCHEDULE
	A	SW10-PMP-0X (X=1-2)
	B	CONTROL POWER
	C	HAND-OFF-AUTO
	D	MOTOR RUNNING
	E	SOFT START FAULT
	F	ELAPSED TIME METER
	G	PUMP PROTECTION RELAY

BILL OF MATERIALS

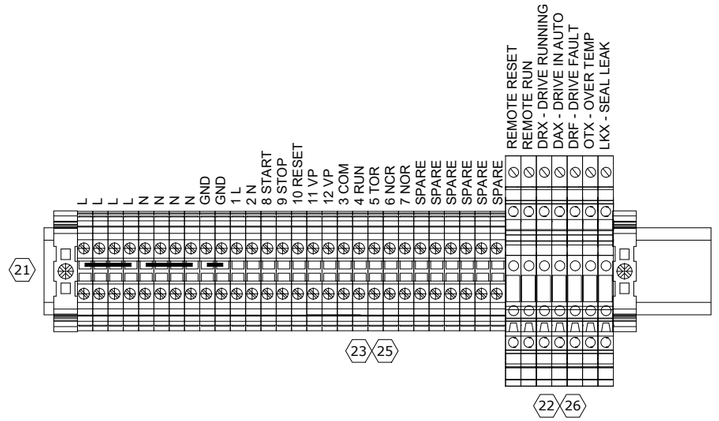
#	ITEM	MANUFACTURER	PART NUMBER	DESCRIPTION
	1	HOFFMAN	A302010LP	ENCLOSURE, 30 x 20 x 10, WALL MOUNT, SINGLE DOOR, NEMA 12
	2	HOFFMAN	A30P20	BACKPANEL, 30 x 20
	3	ABB		EXTERNAL KEYPAD (PSEEK)
	4	ABB	PSE30-600-70	20HP (480V) ND CLASS 10 208-600V SOFT START 100-250VAC CONTROL
	5	ALLEN BRADLEY	1497-A-BASX-0-N	CONTROL TRANSFORMER
	6	ALLEN BRADLEY	1491-R171	FUSE BLOCK CLASS CC 0-30A 3 POLE
	7	MERSEN	ATDR1/4	CLASS CC FUSE - PRIMARY - 1/4 AMP
	8	MERSEN	ATDR8/10	CLASS CC FUSE - SECONDARY - 8/10 AMP
	9	ALLEN BRADLEY	800T-J2B	3 POSITION SELECTOR SWITCH
	10	ALLEN BRADLEY	800T-QTH2G	PUSH-TO-TEST, LED, PILOT LIGHT - GREEN
	11	ALLEN BRADLEY	800T-QTH2R	PUSH-TO-TEST, LED, PILOT LIGHT - RED
	12	ALLEN BRADLEY	800T-QTH2W	PUSH-TO-TEST, LED, PILOT LIGHT - WHITE
	13	IDEC	RJ2S-CL-A120	2PDT CONTROL RELAY, 120VAC
	14	IDEC	RJ2S-05BW	2PDT CONTROL RELAY BASE
	15	ALLEN BRADLEY	700-FSM8UU23	GENERAL PURPOSE TIMING RELAY, MULTI FUNCTION
	16	ALLEN BRADLEY	194U-A60-1753	DISCONNECT SWITCH DIN-RAIL MOUNTED, 60 AMP
	17	ALLEN BRADLEY	194E-SY	DISCONNECT SWITCH HANDLE RED/YELLOW
	18	ALLEN BRADLEY	194U-N1	DISCONNECT WITCH SHAFT 12"
	19	FLYGT	14-407129	MINICAS 120 PUMP MOISTURE/TEMPERATURE RELAY
	20	OMRON	P3GA-11	MINICAS 120 PUMP MOISTURE/TEMPERATURE REVERSE RELAY BASE
	21	PHOENIX CONTACT	1201730	DIN Mounting rail - 35mm
	22	PHOENIX CONTACT	3044814	M 4 FEED THROUGH MULTICONDUCTOR, MULTI-LEVEL TERMINAL
	23	PHOENIX CONTACT	3044102	M 4/6 FEED THROUGH TERMINAL - GREY
	24	PHOENIX CONTACT	3044128	M 4/6 GROUND TERMINAL - GREEN/YELLOW
	25	PHOENIX CONTACT	3047028	END SECTION - GREY
	26	PHOENIX CONTACT	3030271	ASSEMBLED JUMPER BAR 10 POLES
	27	PHOENIX CONTACT	0800886	END STOP - GREY
	28			1" x 2" WHITE LETTERS ON BLACK PHENOLIC NAMEPLATE (SEE SCHEDULE)
	29	TRUMETER	722-0002	6-DIGIT HOUR TIMEMETER INCUDING 10'THS OF HOUR
	30	BURNDY	KA2U	GROUNDING LUG #14 TO #2



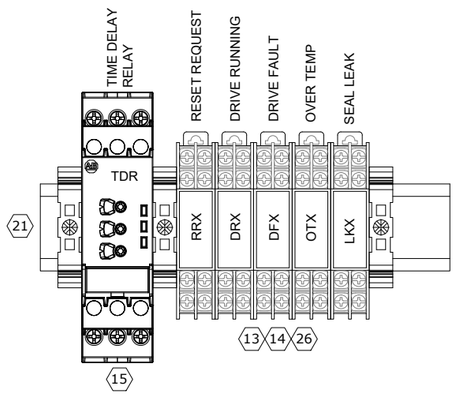
SSRV ENCLOSURE LAYOUT (1)
SCALE: 4" = 1'-0"



SSRV BACKPANEL LAYOUT (2)
SCALE: 4" = 1'-0"



TERMINAL LAYOUT (3)
SCALE: NTS



RELAY LAYOUT (4)
SCALE: NTS

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e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

SHEET 3A-E6 42 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2010 MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ.: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
ELECTRICAL
SOFT STARTER PANEL LAYOUT

consor

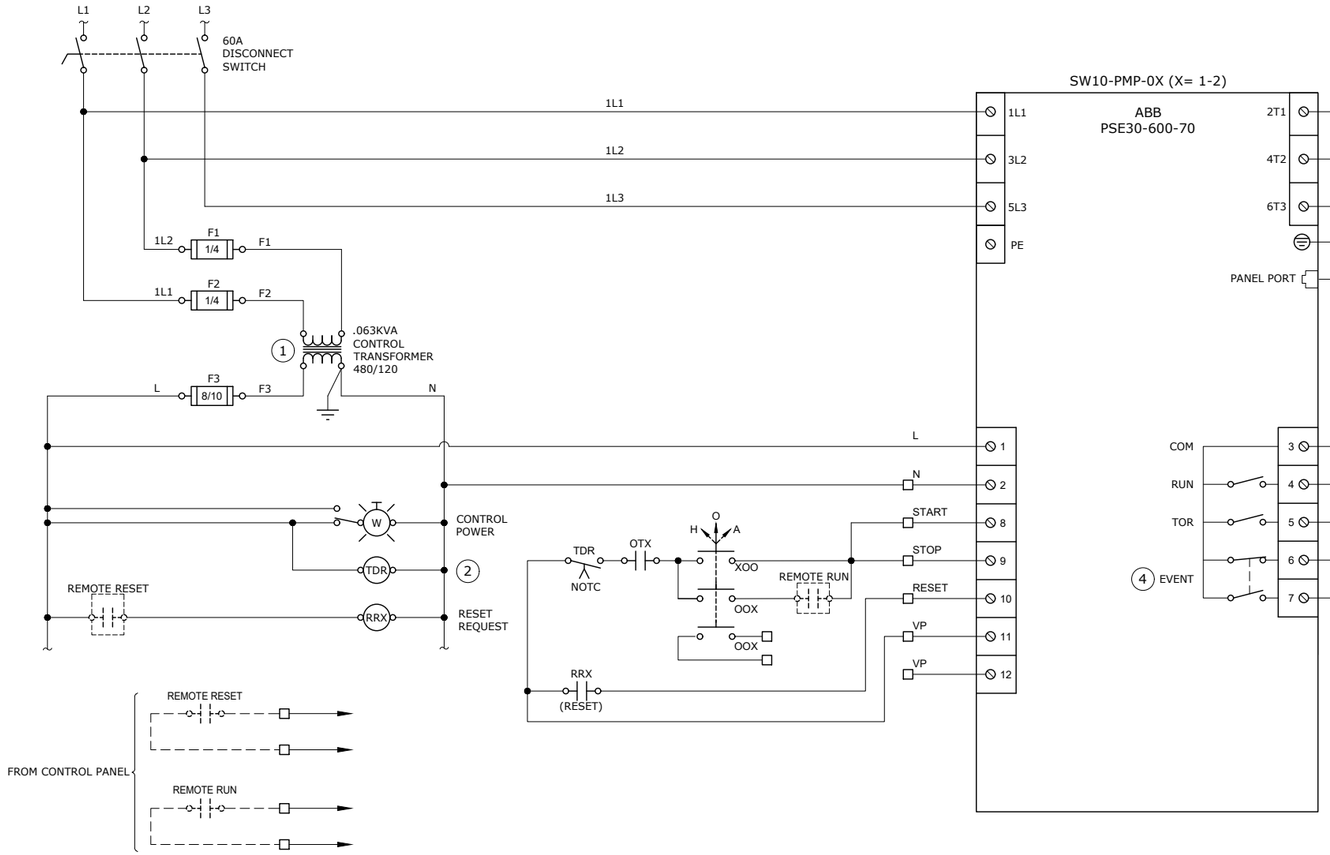
PROJECT: 19-2679 DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

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KEY NOTES

1. FUSING AND CPT SIZED PER PANEL DESIGN PROVIDED ON SIMILAR PREVIOUS PROJECTS. VERIFY AND MODIFY IF REQUIRED.
2. "DELAY ON ENERGIZE" TIME DELAY RELAY, 0-60 SECOND TIMER SET AT 15, & 30 SECONDS FOR PUMPS 1 & 2 RESPECTIVELY.
3. FLYGT MINICAS 120 SENSOR. THERMAL CONTACT CLOSED IN "NORMAL CONDITION", OPENING ON FAULT. LEAK CONTACT OPEN IN "NORMAL CONDITION", CLOSING ON FAULT. MOUNT IN DOOR.
4. CONTACTS ARE SHOWN IN "OFF" STATE. FAULT OUTPUT CONFIGURATIONS:
   ON = NO FAULT + DRIVE POWERED
   OFF = FAULT OR LOSS OF DRIVE POWER



MOTOR CONTROL DIAGRAM

SCALE: NTS

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OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY
		DESIGNED: RSC	
		DRAWN: RSC	
		CHECKED: NEW	
		APPROVED: MEW	

SHEET 3A-E7 43 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2019 MICHAEL E. WALLS
EXPIRES: 6/30/26

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NOTICE IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

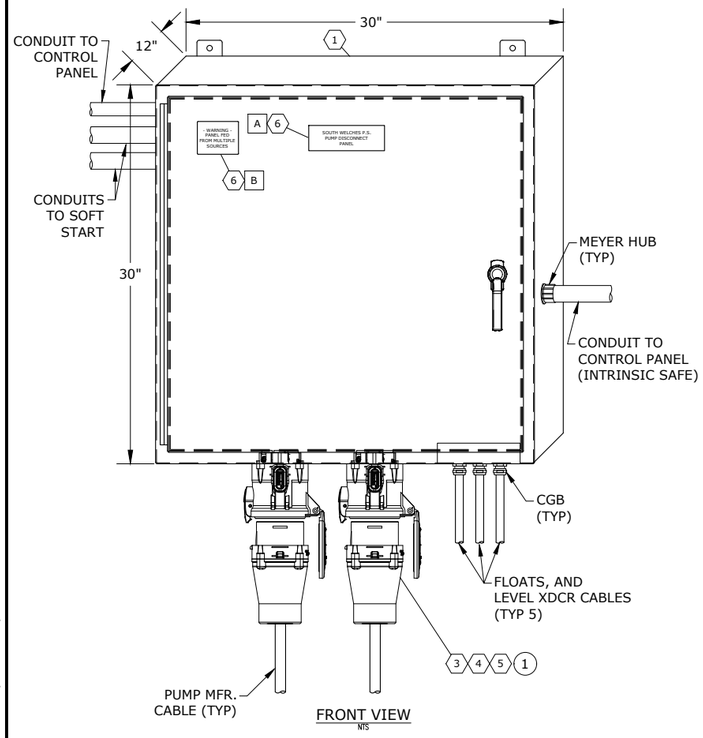
SOUTH WELCHES PUMP STATION
ELECTRICAL
SOFT STARTER WIRING DIAGRAM

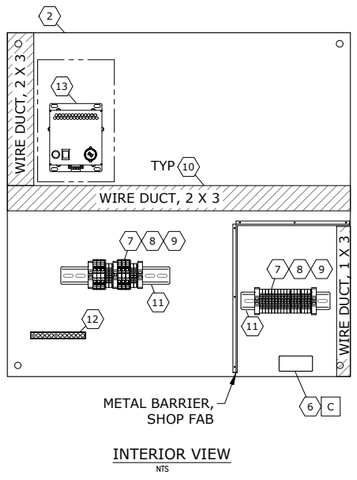
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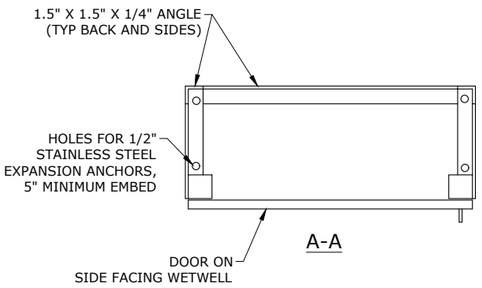
CLACKAMAS WATER ENVIRONMENT SERVICES

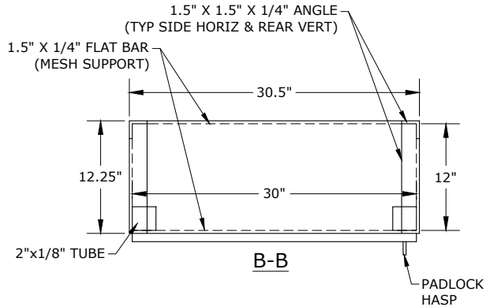
PROJECT: 19-2679 DATE: MAY 2025

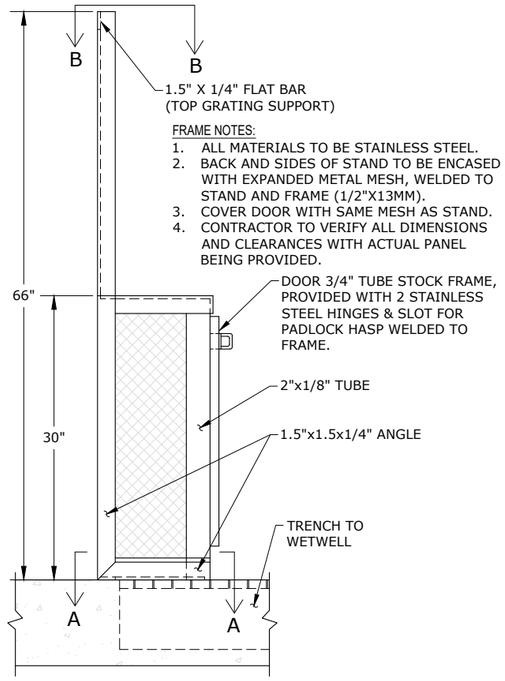
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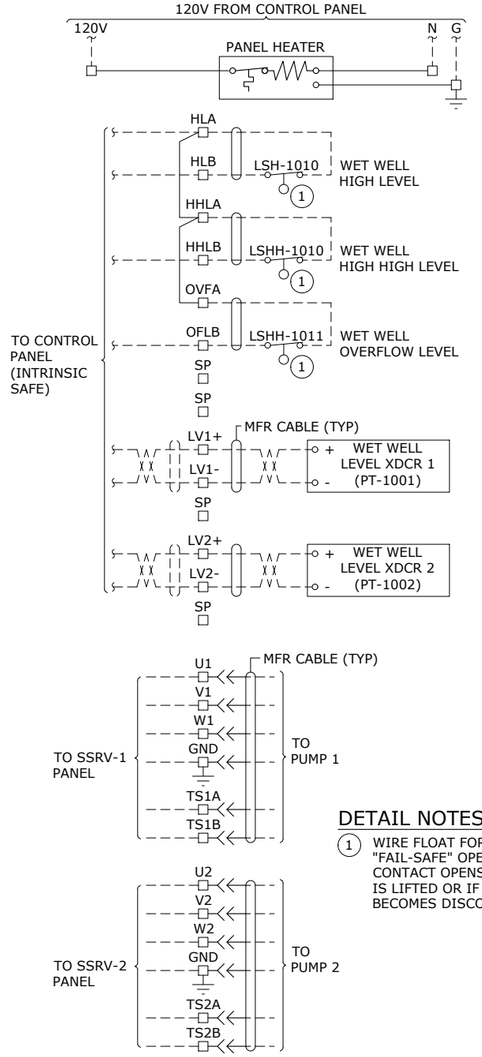




PUMP DISCONNECT PANEL STAND

SCALE: NONE

2 -



DETAIL NOTES

1. WIRE FLOAT FOR "FAIL-SAFE" OPERATION. CONTACT OPENS IF FLOAT IS LIFTED OR IF WIRE BECOMES DISCONNECTED.

PUMP DISCONNECT PANEL WIRING

SCALE: NONE

3 -

DETAIL NOTES

1. LABEL PUMP PLUGS AND PUMP RECEPTACLES WITH POLYPROPYLENE DYMO OR BRADY AGGRESSIVE ADHESIVE $\frac{3}{4}$" HIGH LABELS. LABEL AS "P1", AND "P2" WITH A MINIMUM SIZE 5 FONT.

A	ITEM	NAMEPLATE SCHEDULE
	A	SOUTH WELCHES P.S. PUMP DISCONNECT PANEL
	B	-WARNING- PANEL FED FROM MULTIPLE SOURCES
	C	INTRINSICALLY SAFE AREA

#	ITEM	QUANTITY	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	EQUALS ALLOWED
	1	1	NEMA 4 ENCLOSURE, 30"x30"x12"	SAGINAW	SCE-30EL3012SSLPPL	YES
	2	1	BACK PANEL	SAGINAW	SCE-30P30	YES
	3	2	PUMP RECEPTACLE (HP RATED SWITCH) W/AUX CONTACTS	MELTRIC	DSN SERIES	YES
	4	2	PUMP INLET (HP RATED) W/AUX CONTACTS	MELTRIC	DSN SERIES	YES
	5	2	INLET ACCESSORY HANDLE (SIZED FOR PUMP CABLE)	MELTRIC	DSN SERIES	YES
	6	3	PHENOLIC NAMEPLATE (SEE NAMEPLATE SCHEDULE)	PANEL FABRICATOR CHOICE		YES
	7	A/R	TERMINAL BLOCK (NON FUSED)	PANEL FABRICATOR CHOICE		YES
	8	A/R	TERMINAL BLOCK END STOP	PANEL FABRICATOR CHOICE		YES
	9	A/R	TERMINAL BLOCK END PLATE	PANEL FABRICATOR CHOICE		YES
	10	A/R	WIREWAY (SIZE AS NOTED ON DRAWING)	PANEL FABRICATOR CHOICE		YES
	11	A/R	DIN RAIL	PANEL FABRICATOR CHOICE		YES
	12	1	GROUND BUS	EATON C-H	GBK10	YES
	13	1	HEATER W/T-STAT, 125W	SAGINAW	SCE-HF1251A	YES

LAYOUT AND BILL OF MATERIALS

SCALE: NONE

1 -

NO.	DATE	REVISION	BY

SHEET 3A-E8 44 of 184

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2004 MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ.: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
PUMP DISCONNECT PANEL

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

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HMI

ATS IN GEN. POSITION YI 2010
ATS IN UTILITY POSITION YI 2010A
GEN. RUNNING YI 2011
GEN. FAULT YA 2012
SMOKE YS 1001
BUILD INT. YS 1002
WETWELL LEVEL A LI 1001
WETWELL LEVEL B LI 1002
WETWELL LEVEL HIGH LSH 1010
WETWELL LEVEL HIGH HIGH LSHH 1010A
WETWELL OVERFLOW LSHH 1011

TYPICAL 1 OF 2
HOA IN AUTO YI 1111A
RUNNING YI 1111B
FAULT YA 1111A
OVER TEMP YA 1111B
MOISTURE LEAK YA 1111C
RUN COMMAND YC 1111A
FAULT RESET COMMAND YC 1111B

PLC

IB

1112

SS 1
SS 2

PT 1001
PT 1002
LSH 1010
LSHH 1010
LSHH 1011

ATS
STATION ATS
SW31-ATS-01

GEN
STATION GENERATOR
SW31-GEN-01

YS 1001
SMOKE
SW31-SMK-01

YS 1002
BUILDING INTRUSION

6" FM TO DISCHARGE MH

PI 1111
PI 1112
VALVE VAULT
TO BYPASS PORT

6" FM
4" DR
6"FM

M
20HP
M
20HP
WET WELL

12" SS
INFLUENT MANHOLE

C:\AutoCAD Projects\V255 WES Pump Station Design\South Welches\S_Welches_PID.dwg 3A-IC1 5/7/2025 7:33 AM PEI 24.0s (LMS Tech)

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3A-IC1 45 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON DEC. 17, 2024 CARL M. SIEBEN
EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION P&ID

consor

DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679

PORTLAND Engineering Inc.

I/O	Description	Channel	Loop Sheet
AI	SPARE	SLOT 1, CH 0	3A-IC6
AI	WET WELL LEVEL 1	SLOT 1, CH 1	3A-IC6
AI	WET WELL LEVEL 2	SLOT 1, CH 2	3A-IC6
AI	SPARE	SLOT 1, CH 3	3A-IC6
AI	SPARE	SLOT 1, CH 4	3A-IC6
AI	SPARE	SLOT 1, CH 5	3A-IC6
AI	SPARE	SLOT 1, CH 6	3A-IC6
AI	SPARE	SLOT 1, CH 7	3A-IC7
DI	POWER FAIL RELAY	SLOT 2, CH 0	3A-IC7
DI	POWER SUPPLY 1 STATUS	SLOT 2, CH 1	3A-IC7
DI	POWER SUPPLY 2 STATUS	SLOT 2, CH 2	3A-IC7
DI	ATS IN GEN POSITION	SLOT 2, CH 3	3A-IC7
DI	ATS IN UTILITY POSITION	SLOT 2, CH 4	3A-IC7
DI	GENERATOR RUNNING	SLOT 2, CH 5	3A-IC7
DI	GENERATOR FAULT	SLOT 2, CH 6	3A-IC7
DI	SPARE	SLOT 2, CH 7	3A-IC7
DI	PUMP 1 LEAK ALARM	SLOT 2, CH 8	3A-IC8
DI	PUMP 1 OVER TEMP	SLOT 2, CH 9	3A-IC8
DI	PUMP 1 HOA IN AUTO	SLOT 2, CH 10	3A-IC8
DI	PUMP 1 RUNNING	SLOT 2, CH 11	3A-IC8
DI	PUMP 1 FAULT	SLOT 2, CH 12	3A-IC8
DI	SPARE	SLOT 2, CH 13	3A-IC8
DI	SPARE	SLOT 2, CH 14	3A-IC8
DI	SPARE	SLOT 2, CH 15	3A-IC8

I/O	Description	Channel	Loop Sheet
DI	BUILDING SMOKE ALARM	SLOT 3, CH 0	3A-IC9
DI	SPARE	SLOT 3, CH 1	3A-IC9
DI	WET WELL HIGH FLOAT	SLOT 3, CH 2	3A-IC9
DI	WET WELL HIGH HIGH FLOAT	SLOT 3, CH 3	3A-IC9
DI	WET WELL OVER FLOW FLOAT	SLOT 3, CH 4	3A-IC9
DI	SPARE	SLOT 3, CH 5	3A-IC9
DI	SPARE	SLOT 3, CH 6	3A-IC9
DI	SPARE	SLOT 3, CH 7	3A-IC9
DI	PUMP 2 LEAK ALARM	SLOT 3, CH 8	3A-IC10
DI	PUMP 2 OVER TEMP	SLOT 3, CH 9	3A-IC10
DI	PUMP 2 HOA IN AUTO	SLOT 3, CH 10	3A-IC10
DI	PUMP 2 RUNNING	SLOT 3, CH 11	3A-IC10
DI	PUMP 2 FAULT	SLOT 3, CH 12	3A-IC10
DI	SPARE	SLOT 3, CH 13	3A-IC10
DI	SPARE	SLOT 3, CH 14	3A-IC10
DI	SPARE	SLOT 3, CH 15	3A-IC10
DO	PUMP 1 RUN COMMAND	SLOT 4, CH 0	3A-IC11
DO	PUMP 1 RESET COMMAND	SLOT 4, CH 1	3A-IC11
DO	PUMP 2 RUN COMMAND	SLOT 4, CH 2	3A-IC11
DO	PUMP 2 RESET COMMAND	SLOT 4, CH 3	3A-IC11
DO	SPARE	SLOT 4, CH 4	3A-IC11
DO	SPARE	SLOT 4, CH 5	3A-IC11
DO	SPARE	SLOT 4, CH 6	3A-IC11
DO	SPARE	SLOT 4, CH 7	3A-IC11
DO	ALARM 1 TO TELEMETRY PLC	SLOT 4, CH 8	3A-IC12
DO	ALARM 2 TO TELEMETRY PLC	SLOT 4, CH 9	3A-IC12
DO	ALARM 3 TO TELEMETRY PLC	SLOT 4, CH 10	3A-IC12
DO	ALARM 4 TO TELEMETRY PLC	SLOT 4, CH 11	3A-IC12
DO	ALARM 5 TO TELEMETRY PLC	SLOT 4, CH 12	3A-IC12
DO	ALARM 6 TO TELEMETRY PLC	SLOT 4, CH 13	3A-IC12
DO	ALARM 7 TO TELEMETRY PLC	SLOT 4, CH 14	3A-IC12
DO	ALARM 8 TO TELEMETRY PLC	SLOT 4, CH 15	3A-IC12

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3A-IC2
46 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — DEC. 17, 2024 — CARL M. SIEBEN
EXPIRES: 06/30/2026

SCALE VERT: HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

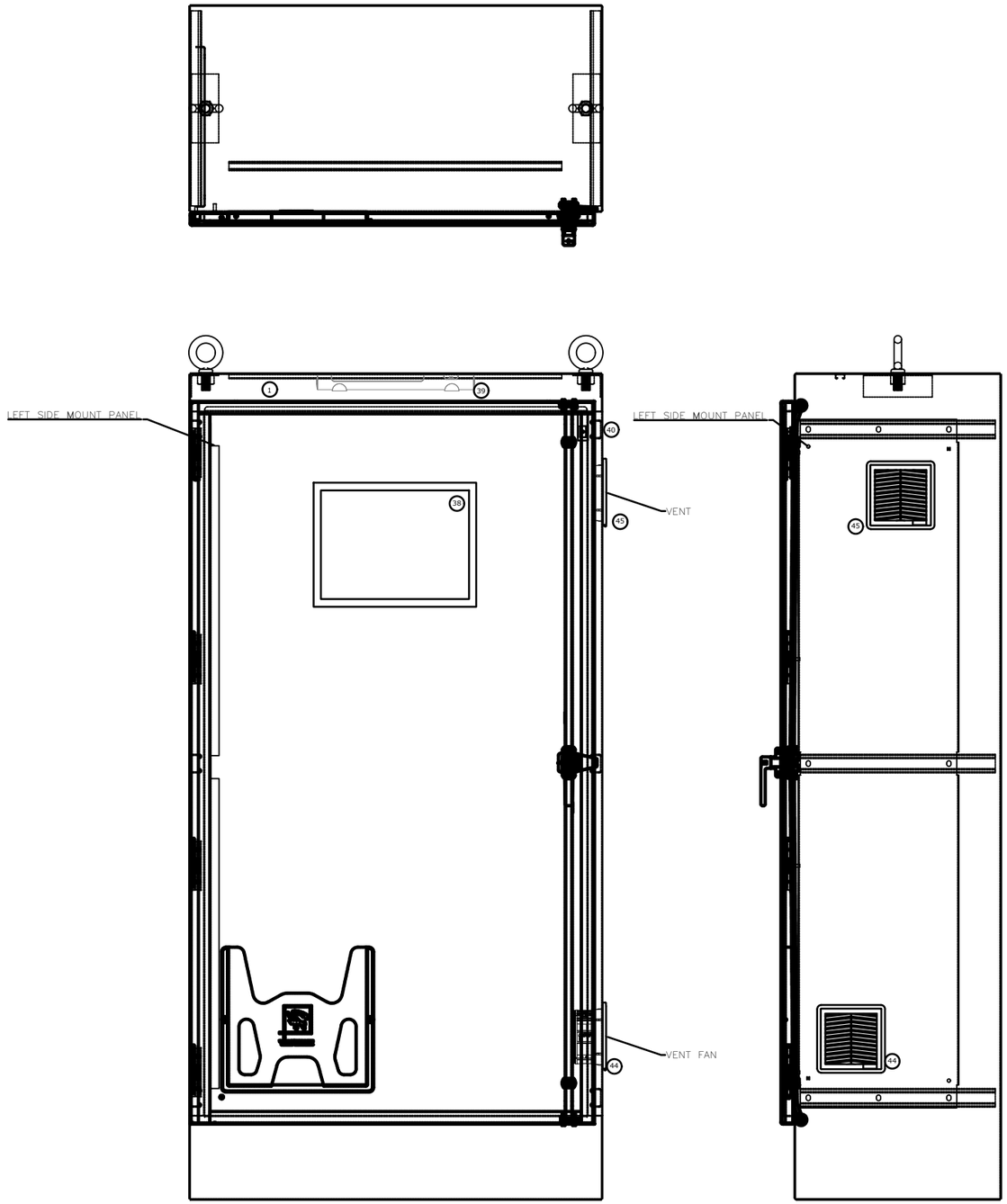
SOUTH WELCHES PUMP STATION
IO LIST

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

C:\AutoCAD Projects\V255 WES Pump Station Design\South Welches\S_Welches-IND.dwg 3A-IC2 5/5/2025 9:32 AM PEI 24.0s (LMS Tech)



ITEM	QTY	BRAND	PART NUMBER	DESCRIPTION
1	1	HOFFMAN	A723618FS	NEMA 12 ENCLOSURE, 72" BY 36" BY 18"
2	1	HOFFMAN	A72P36F1	BACK PANEL, 60" BY 32"
3	1	HOFFMAN	A72SMP14	SIDE PANEL, 60" BY 14"
4	2	CUTLER HAMMER	GBK10	GROUND BAR
5	2	SOLA	SDN-10-24-100C	P/S 10A 24VDC 115/230
6	1	NTRON	108TX	8 PORT INDUSTRIAL ETHERNET SWITCH
7	10	ALLEN BRADLEY	1492-JG4	GROUND TERMINAL
8	1	ALTECH	1DU15L	MAIN CIRCUIT BREAKER, 15A
9	30	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK
10	35	ALLEN BRADLEY	1492-WFB424	FUSED TERMINAL, 24VDC, INDICATOR
11	6	ALLEN BRADLEY	1492-WFB4250	FUSED TERMINAL, 120VAC, INDICATOR
12	0	ALLEN BRADLEY	1492-WFB4	FUSED TERMINAL, NO INDICATOR
13	AR	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER
14	AR	ALLEN BRADLEY	1492-ERL35	J SCREWLESS END STOP
15	1	SIEMENS	6ES7511-1AK02-0AB0	S7-1500 CPU
16	1	SIEMENS	6ES7954-8LC02-0AA0	MEMORY CARD
17	1	SIEMENS	6ES7590-1AC40-0AA0	PLC MOUNTING RAIL
18	2	SIEMENS	6ES7521-1BH00-0AB0	DIGITAL INPUT MODULE, 16 PT, 24VDC
19	1	SIEMENS	6ES7531-7NF00-0AB0	ANALOG INPUT MODULE, 8 PT, ISOLATED, I/V
20	1	SIEMENS	6ES7522-1BH01-0AB0	DIGITAL OUTPUT MODULE, 16 PT, 24VDC
21				
22	3	SIEMENS	6ES7921-5AB20-0AA0	DIGITAL IO MODULE FRONT CONNECTOR
23	1	SIEMENS	6ES7921-5AK20-0AA0	ANALOG IO MODULE FRONT CONNECTOR
24	4	SIEMENS	6ES7924-0AA20-0AA0	DI TERMINATION MODULE 8 point
25	2	SIEMENS	6ES7924-0BD20-0BA0	DO 24VDC RELAY TERMINATION MODULE, LED 8 point
27	4	SIEMENS	6ES7924-0CC20-0AA0	AI TERMINATION MODULE
28	4	SIEMENS	6ES7923-0BB00-0DB0	CABLE, 16 PIN IDC, SHIELD, 1M FOR ANALOG
29	1	PHOENIX	5600462	DUPLEX OUTLET FOR UPS
30	6	SIEMENS	6ES7923-0BB50-0CB0	CABLE, 16 PIN IDC, 1.5M FOR DIGITAL MODULE
31	3	ALLEN-BRADLEY	700-HN-101	RELAY SOCKET
32	1	ALLEN-BRADLEY	700-HA33A1	RELAY, 120VAC COIL, 3 POLE
33	2	ALLEN-BRADLEY	700-HA33A24	RELAY, 24VDC COIL, 3 POLE
34	2	ALLEN-BRADLEY	700-FSM7UU23	TIMING RELAY
35	3	TURCK	IM1-121EX-R	INTRINSIC BARRIER, DISCRETE SIGNAL
36	2	TURCK	IM33-11EX-HI	INTRINSIC BARRIER, ANALOG SIGNAL
37				
38	1	EZ AUTOMATION	EZ3-T10C-E	10" TOUCH SCREEH HMI, 800X600 RES
39	1	STEGO	02541.0-00-0003	PANEL LIGHT, 120VAC LED, MOTION, MAGNETIC
40	1	HOFFMAN	ALFSWD	DOOR SWITCH
41	1	SOLA	SDN2X20RED	24VDC REDUNDANCY MODULE
42	1	SOLA	SDU-10-24B	DC UPS POWER MODULE, 10A 24VDC
43	1	SOLA	SDU-24-BATEM	DC UPS BATTERY MODULE
44	1	SAGINAW	SCE-N12FA44	FILTER FAN, 120VAC
45	1	SAGINAW	SCE-N12FGA44	EXHAUST VENT
46	1	STEGO	01141.9-00	THERMOSTAT
47				
48	1	SHOP SUPPLY	UL LABEL	UL INDUSTRIAL LABEL
49	AR	SHOP SUPPLY	ENGRAVE PLAS NP	PLASTIC NAME PLATES
50	AR	SHOP SUPPLY		35 mm DIN RAIL
51	AR	SHOP SUPPLY		WIRE DUCT
52	AR	SHOP SUPPLY		WIRE DUCT COVER, WHITE

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DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3A-IC3 47 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.: NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
PANEL EXTERIOR LAYOUT

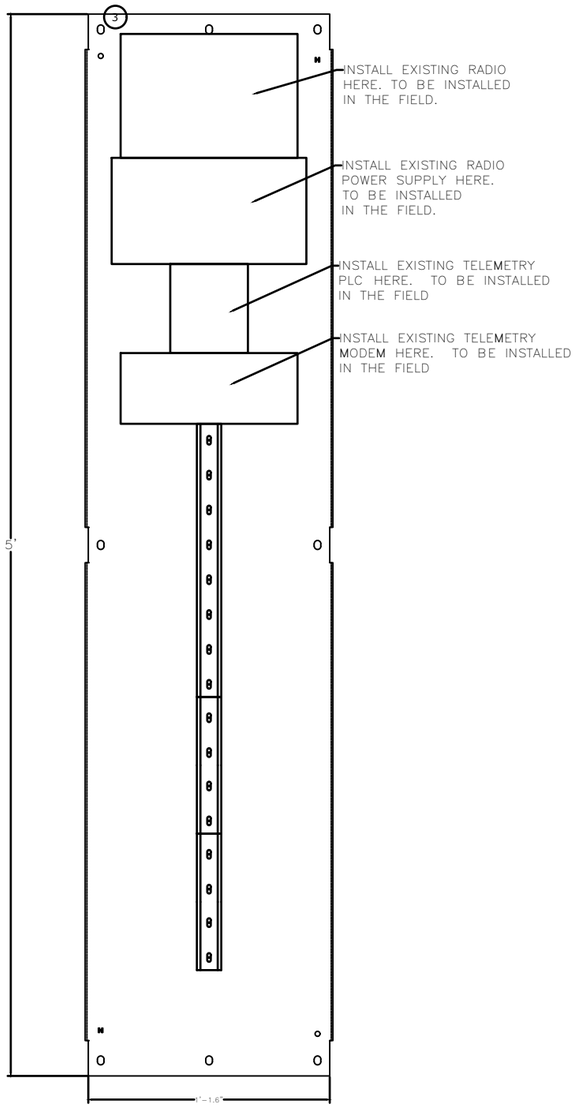
consor

CLACKAMAS WATER ENVIRONMENT SERVICES

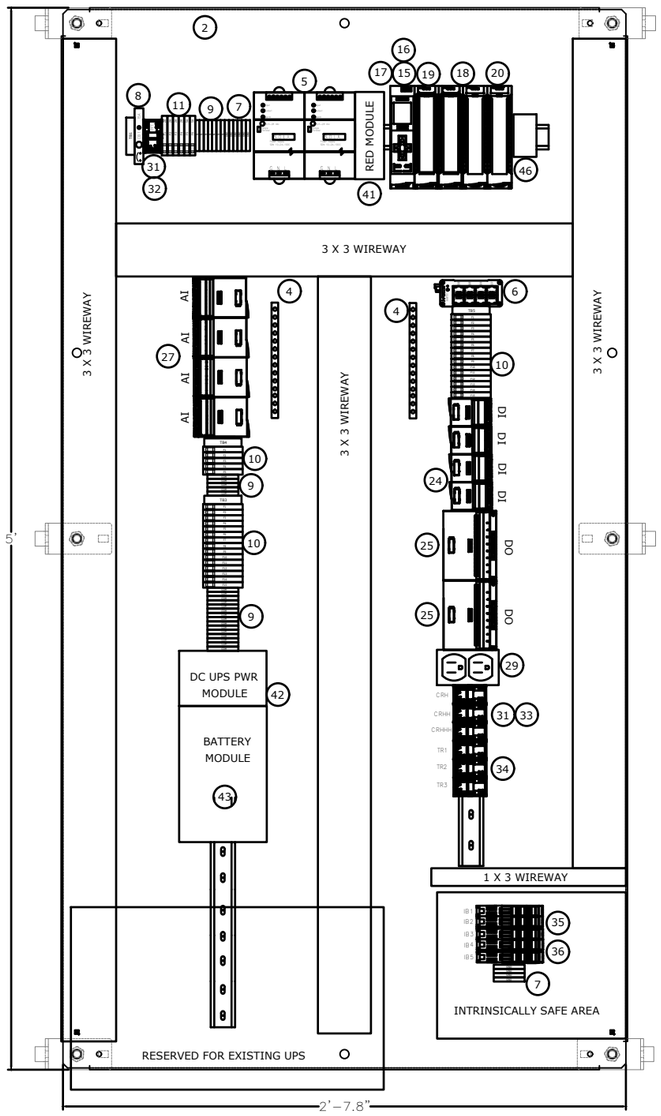
PROJECT: 19-2679 DATE: MAY 2025

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LEFT SIDE MOUNT PANEL



BACK PANEL



ITEM	QTY	BRAND	PART NUMBER	DESCRIPTION
1	1	HOFFMAN	A723618FS	NEMA 12 ENCLOSURE, 72" BY 36" BY 18"
2	1	HOFFMAN	A72P36F1	BACK PANEL, 60" BY 32"
3	1	HOFFMAN	A72SMP14	SIDE PANEL, 60" BY 14"
4	2	CUTLER HAMMER	GBK10	GROUND BAR
5	2	SOLA	SDN-10-24-100C	P/S 10A 24VDC 115/230
6	1	NTRON	108TX	8 PORT INDUSTRIAL ETHERNET SWITCH
7	10	ALLEN BRADLEY	1492-JG4	GROUND TERMINAL
8	1	ALTECH	1DU15L	MAIN CIRCUIT BREAKER, 15A
9	30	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK
10	35	ALLEN BRADLEY	1492-WFB424	FUSED TERMINAL, 24VDC, INDICATOR
11	6	ALLEN BRADLEY	1492-WFB4250	FUSED TERMINAL, 120VAC, INDICATOR
12	0	ALLEN BRADLEY	1492-WFB4	FUSED TERMINAL, NO INDICATOR
13	AR	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER
14	AR	ALLEN BRADLEY	1492-ERL35	J SCREWLESS END STOP
15	1	SIEMENS	6ES7511-1AK02-0AB0	S7-1500 CPU
16	1	SIEMENS	6ES7954-8LC02-0AA0	MEMORY CARD
17	1	SIEMENS	6ES7590-1AC40-0AA0	PLC MOUNTING RAIL
18	2	SIEMENS	6ES7521-1BH00-0AB0	DIGITAL INPUT MODULE, 16 PT, 24VDC
19	1	SIEMENS	6ES7531-7NF00-0AB0	ANALOG INPUT MODULE, 8 PT, ISOLATED, I/V
20	1	SIEMENS	6ES7522-1BH01-0AB0	DIGITAL OUTPUT MODULE, 16 PT, 24VDC
21				
22	3	SIEMENS	6ES7921-5AB20-0AA0	DIGITAL IO MODULE FRONT CONNECTOR
23	1	SIEMENS	6ES7921-5AK20-0AA0	ANALOG IO MODULE FRONT CONNECTOR
24	4	SIEMENS	6ES7924-0AA20-0AA0	DI TERMINATION MODULE 8 point
25	2	SIEMENS	6ES7924-0BD20-0BA0	DO 24VDC RELAY TERMINATION MODULE, LED 8 point
27	4	SIEMENS	6ES7924-0CC20-0AA0	AI TERMINATION MODULE
28	4	SIEMENS	6ES7923-0BB00-0DB0	CABLE, 16 PIN IDC, SHIELD, 1M FOR ANALOG
29	1	PHOENIX	5600462	DUPLEX OUTLET FOR UPS
30	6	SIEMENS	6ES7923-0BB50-0CB0	CABLE, 16 PIN IDC, 1.5M FOR DIGITAL MODULE
31	3	ALLEN-BRADLEY	700-HN-101	RELAY SOCKET
32	1	ALLEN-BRADLEY	700-HA33A1	RELAY, 120VAC COIL, 3 POLE
33	2	ALLEN-BRADLEY	700-HA33A24	RELAY, 24VDC COIL, 3 POLE
34	2	ALLEN-BRADLEY	700-FSM7UU23	TIMING RELAY
35	3	TURCK	IM1-121EX-R	INTRINSIC BARRIER, DISCRETE SIGNAL
36	2	TURCK	IM33-11EX-HI	INTRINSIC BARRIER, ANALOG SIGNAL
37				
38	1	EZ AUTOMATION	EZ3-T10C-E	10" TOUCH SCREEH HMI, 800X600 RES
39	1	STEGO	02541.0-00-0003	PANEL LIGHT, 120VAC LED, MOTION, MAGNETIC
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41	1	SOLA	SDN2X20RED	24VDC REDUNDANCY MODULE
42	1	SOLA	SDU-10-24B	DC UPS POWER MODULE, 10A 24VDC
43	1	SOLA	SDU-24-BATEM	DC UPS BATTERY MODULE
44	1	SAGINAW	SCE-N12FA44	FILTER FAN, 120VAC
45	1	SAGINAW	SCE-N12FGA44	EXHAUST VENT
46	1	STEGO	01141.9-00	THERMOSTAT
47				
48	1	SHOP SUPPLY	UL LABEL	UL INDUSTRIAL LABEL
49	AR	SHOP SUPPLY	ENGRAVE PLAS NP	PLASTIC NAME PLATES
50	AR	SHOP SUPPLY		35 mm DIN RAIL
51	AR	SHOP SUPPLY		WIRE DUCT
52	AR	SHOP SUPPLY		WIRE DUCT COVER, WHITE

SHEET NOTES:

1. INSTALL BARRIER TO SEPARATE INTRINSICALLY SAFE AREA FROM OTHER PANEL COMPONENTS.

NO.	DATE	REVISION	BY

SHEET 3A-IC4 48 of 184

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
PANEL INTERIOR LAYOUT

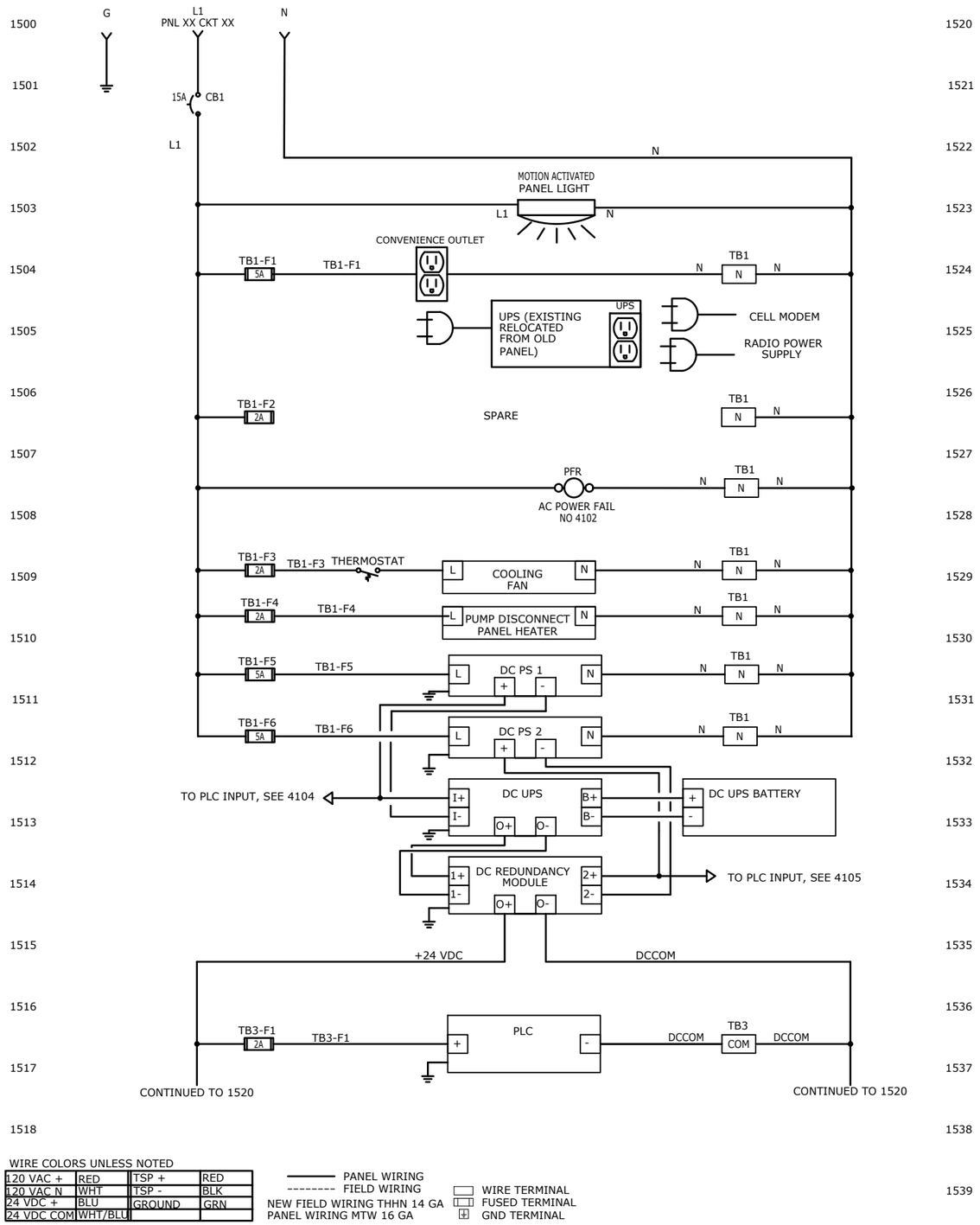
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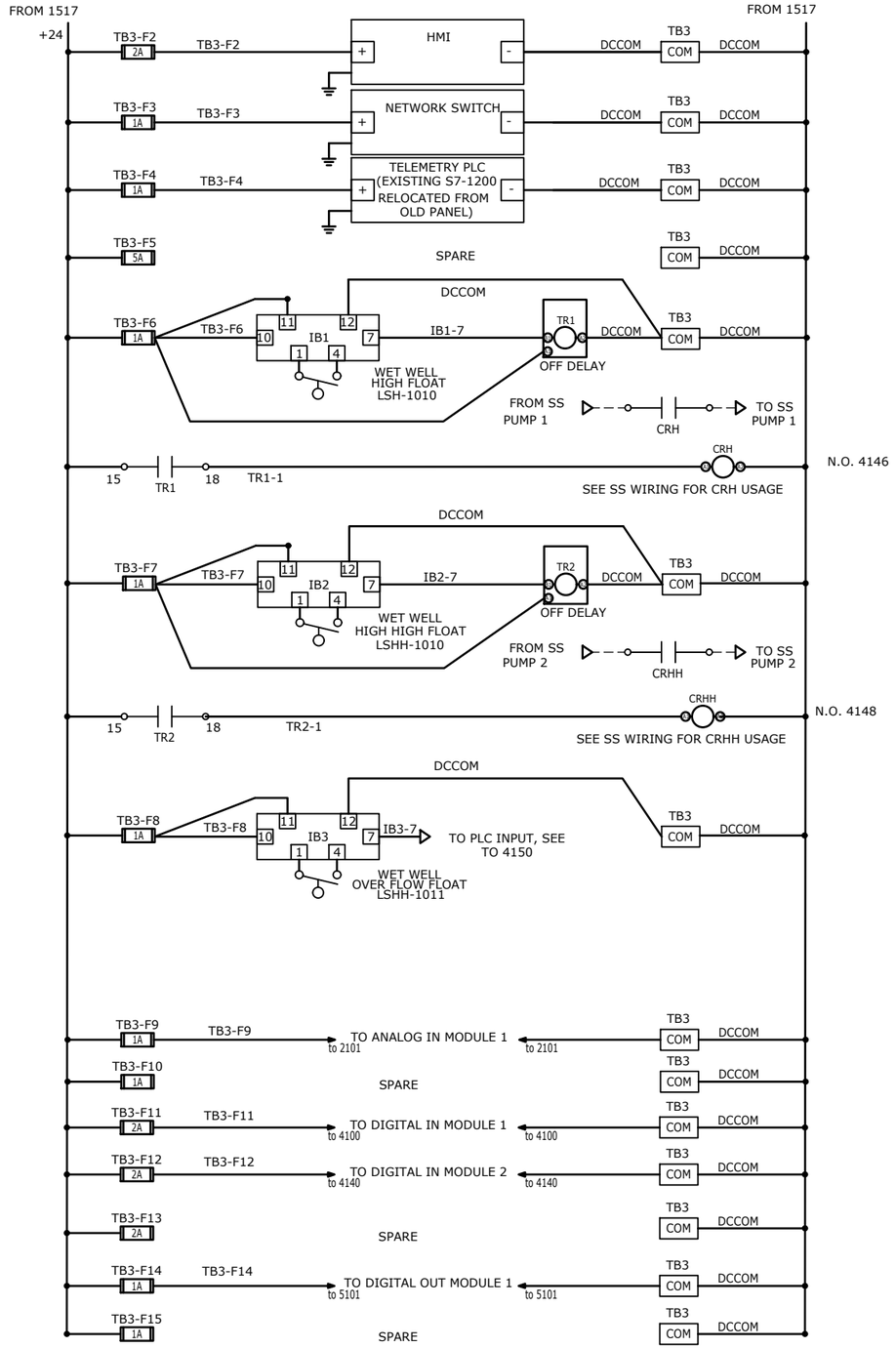
CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

PORTLAND Engineering Inc.

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WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

SHEET 3A-IC5 49 of 184

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. WEBB — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.: NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

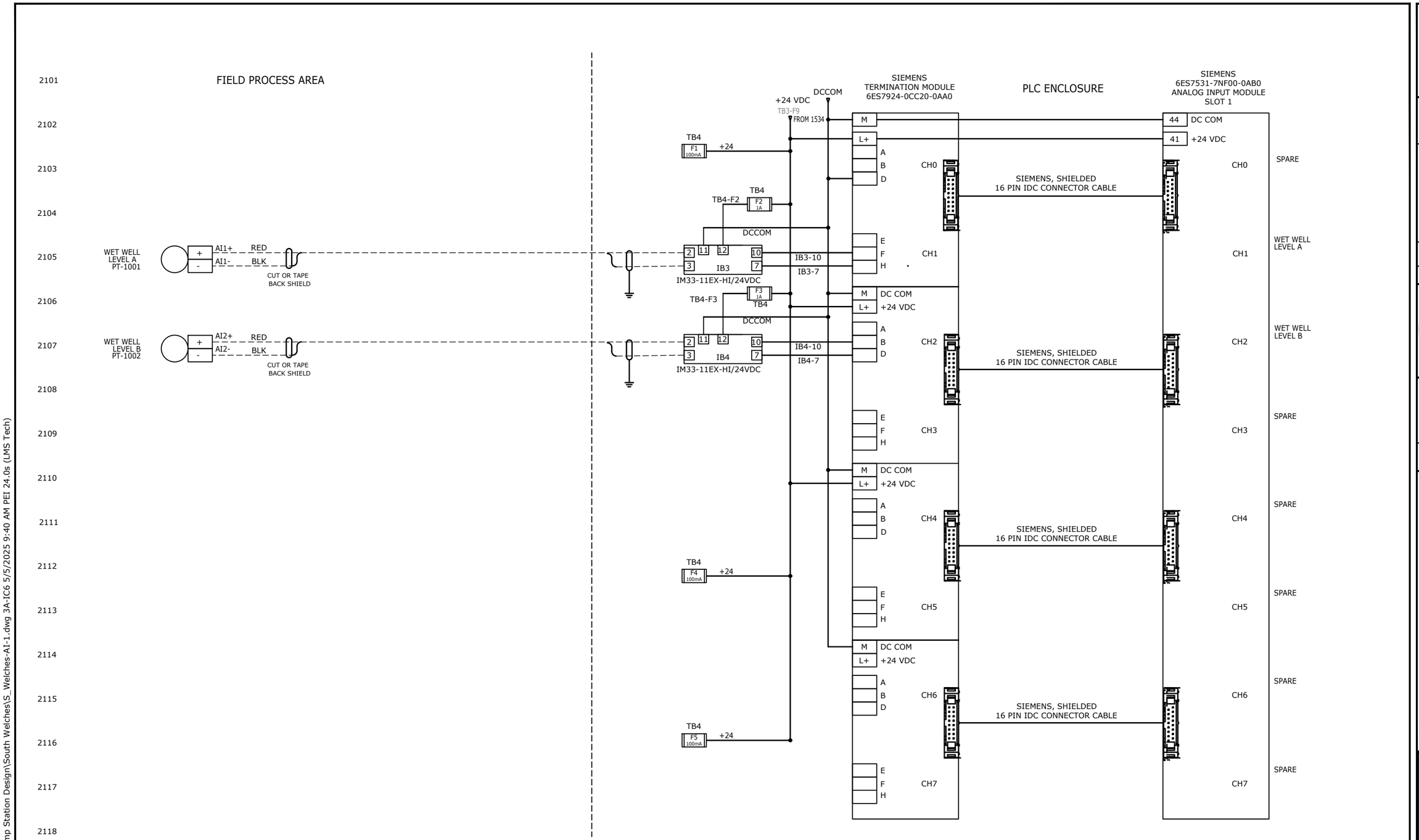
SOUTH WELCHES PUMP STATION
POWER DISTRIBUTION

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

SHEET 3A-IC6 50 of 184

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — KWAME CARL M. WORKS — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.: NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

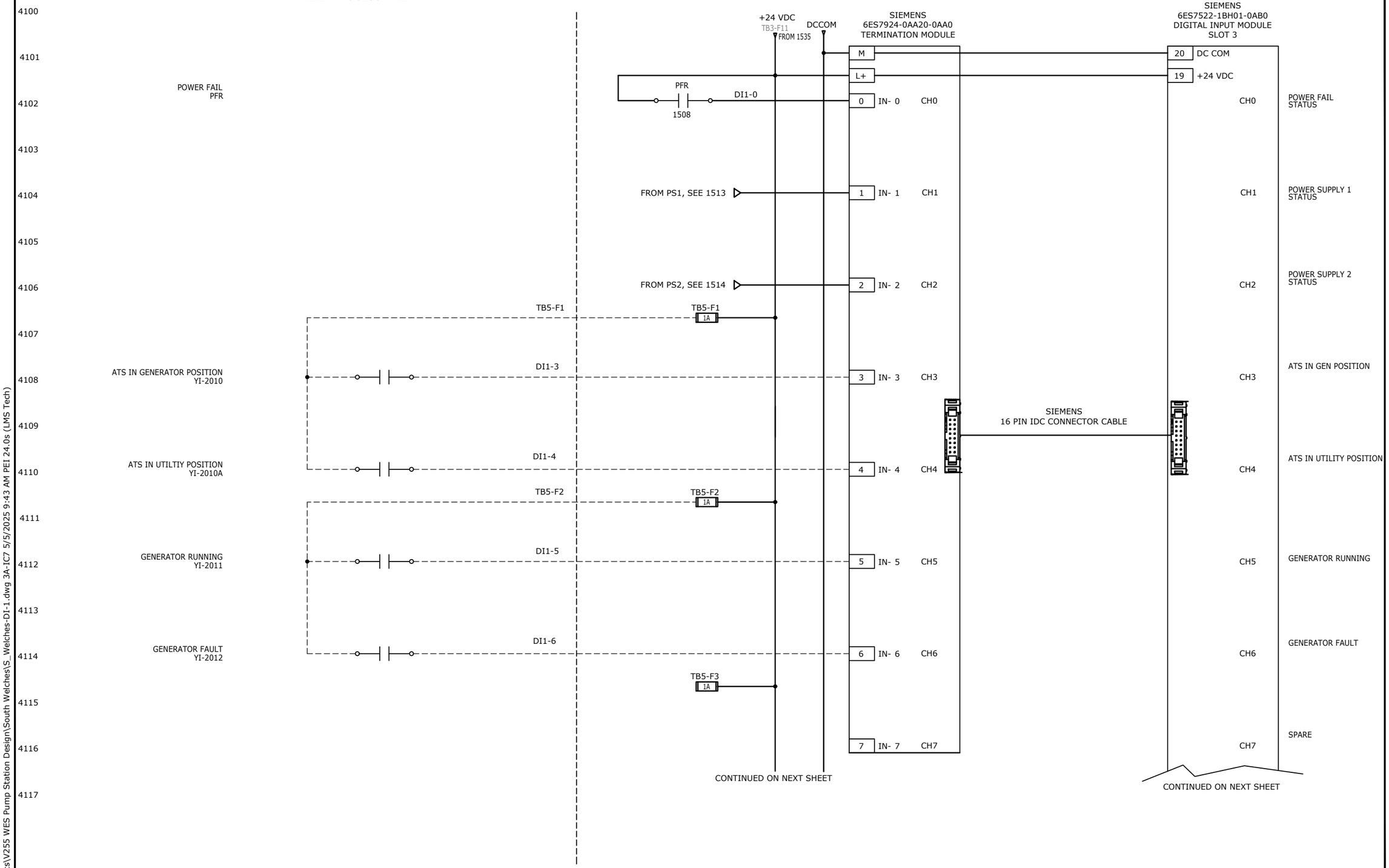
SOUTH WELCHES PUMP STATION
ANALOG INPUT

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

FIELD PROCESS AREA



WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3A-IC7 51 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

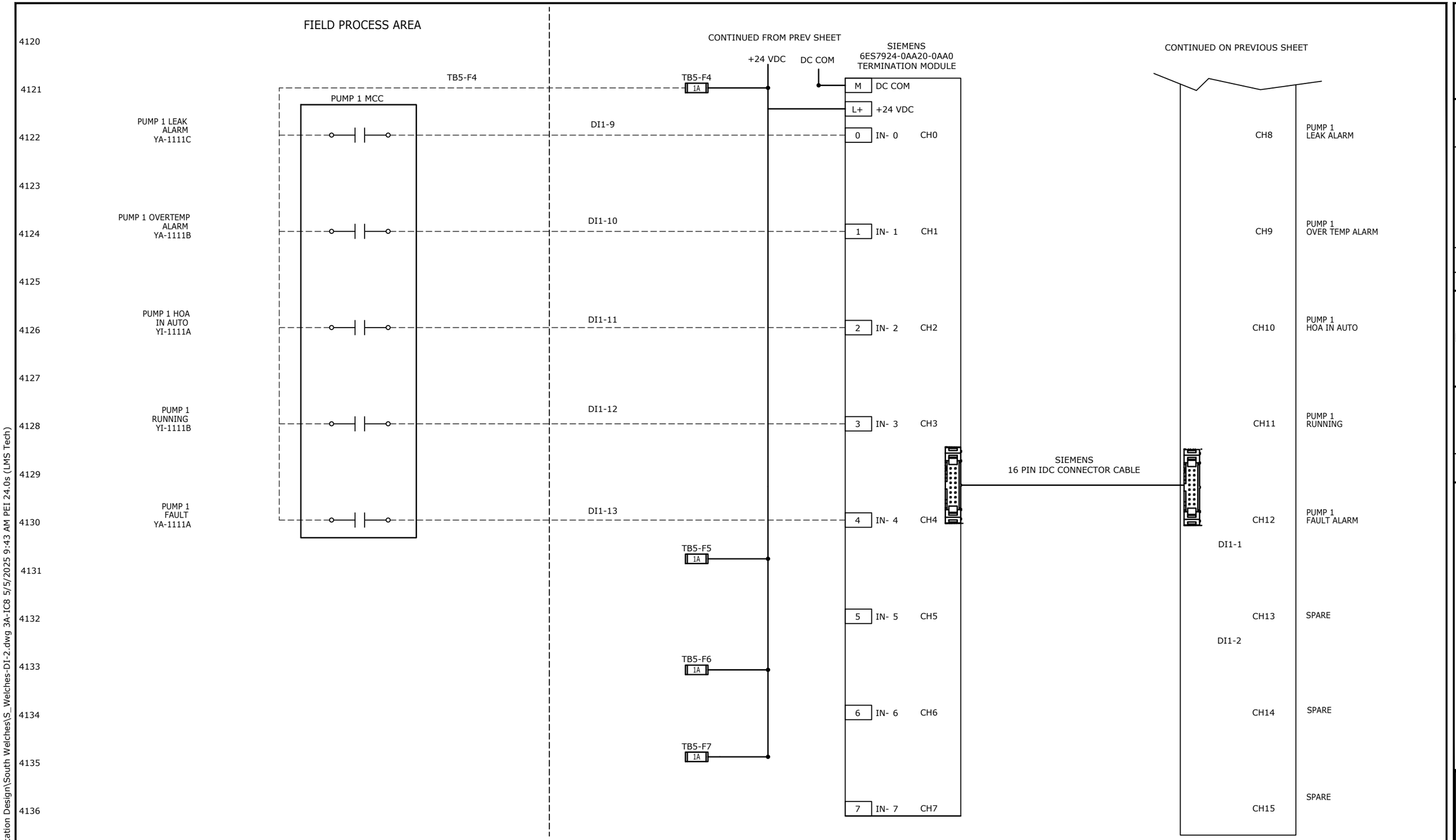
SOUTH WELCHES PUMP STATION
DIGITAL INPUT - 1

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CLACKAMAS WATER ENVIRONMENT SERVICES

DATE: MAY 2025
PROJECT: 19-2679

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WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

SHEET 3A-IC8 52 of 184

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER OREGON CARL M. SIEBEN EXPIRES: 06/30/2026

SCALE VERT: HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
DIGITAL INPUT - 2

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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FIELD PROCESS AREA

SIEMENS 6ES7924-0AA20-0AA0 TERMINATION MODULE

SIEMENS 6ES7522-1BH01-0AB0 DIGITAL INPUT MODULE SLOT 4

+24 VDC
TB3-F12
FROM 1536

DCCOM

4140						
4141		TB5-F8 → 1A	M	20	DC COM	
			L+	19	+24 VDC	
4142	SMOKE ELECT RM. YS-1001	DI2-0	0 IN- 0	CH0	CH0	SMOKE ALARM ELECT ROOM
4143		TB5-F9 → 1A				
4144	BUILDING INTRUSION YS-1002	DI2-1	1 IN- 1	CH1	CH1	BUILDING INTRUSION
4145						
4146	WET WELL HIGH LEVEL FLOAT LSH-1010	CRH 1526 DI2-2	2 IN- 2	CH2	CH2	WET WELL HIGH FLOAT
4147						
4148	WET WELL HIGH HIGH LEVEL FLOAT LSHH-1010	CRHH 1528 DI2-3	3 IN- 3	CH3	CH3	WET WELL HIGH HIGH FLOAT
4149						
4150	WET WELL OVER FLOW LEVEL FLOAT LSHH-1011	IB3-7 IB3 1531 DI2-4	4 IN- 4	CH4	CH4	WET WELL OVER FLOW FLOAT
4151		TB5-F10 → 1A				
4152			5 IN- 5	CH5	CH5	SPARE
4153						
4154			6 IN- 6	CH6	CH6	SPARE
4155		TB5-F11 → 1A				
4156			7 IN- 7	CH7	CH7	SPARE
4157						

SIEMENS 16 PIN IDC CONNECTOR CABLE

CONTINUED ON NEXT SHEET

CONTINUED ON NEXT SHEET

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

PANEL WIRING
FIELD WIRING
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

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DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3A-IC9 53 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBER — DEC. 17, 2024 — RENEWAL: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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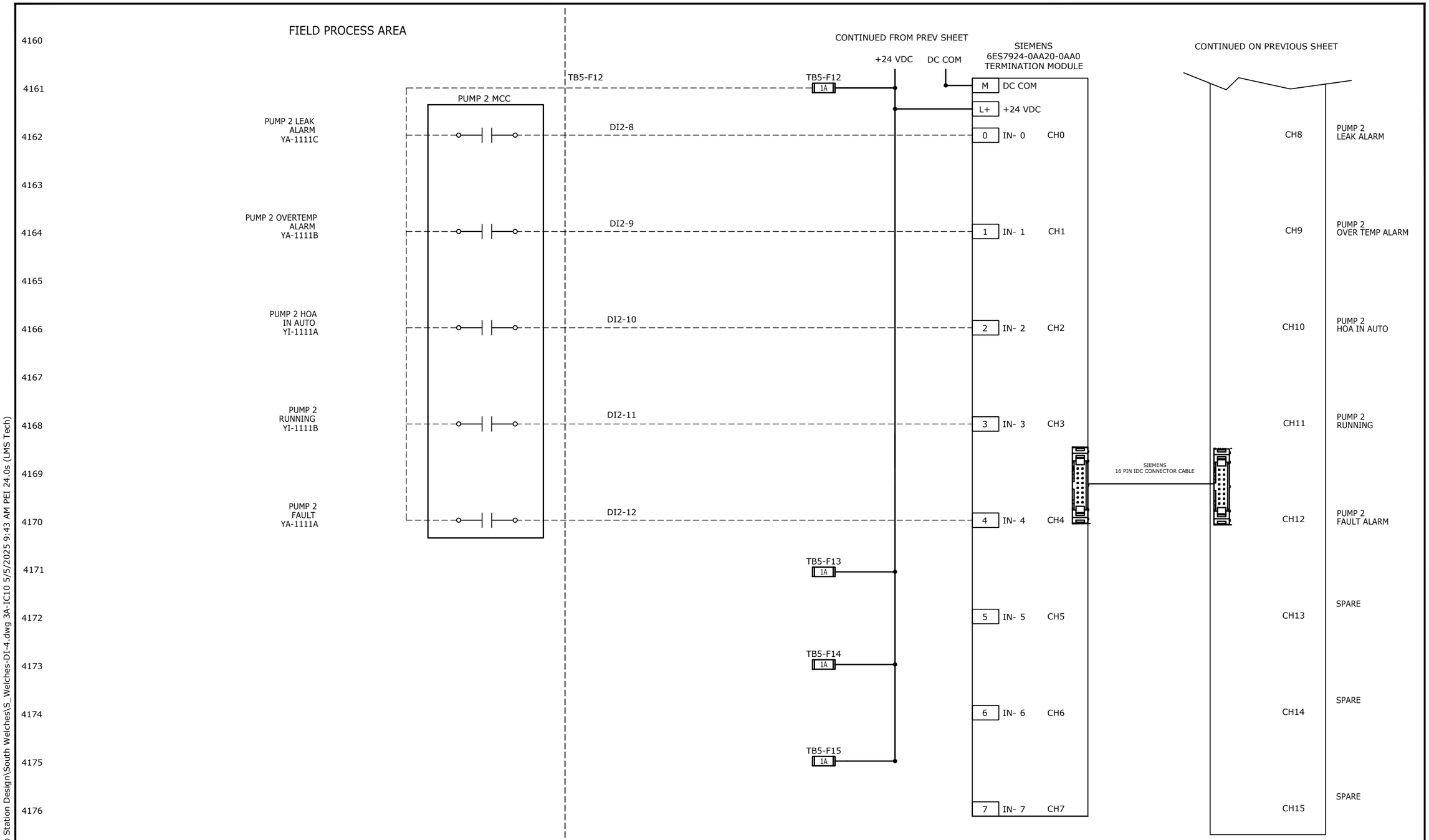
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
DIGITAL INPUT - 3

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES



WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3A-IC10 54 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — DEC. 17, 2024 — EXPIRES: 06/30/2026

SCALE VERT: HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

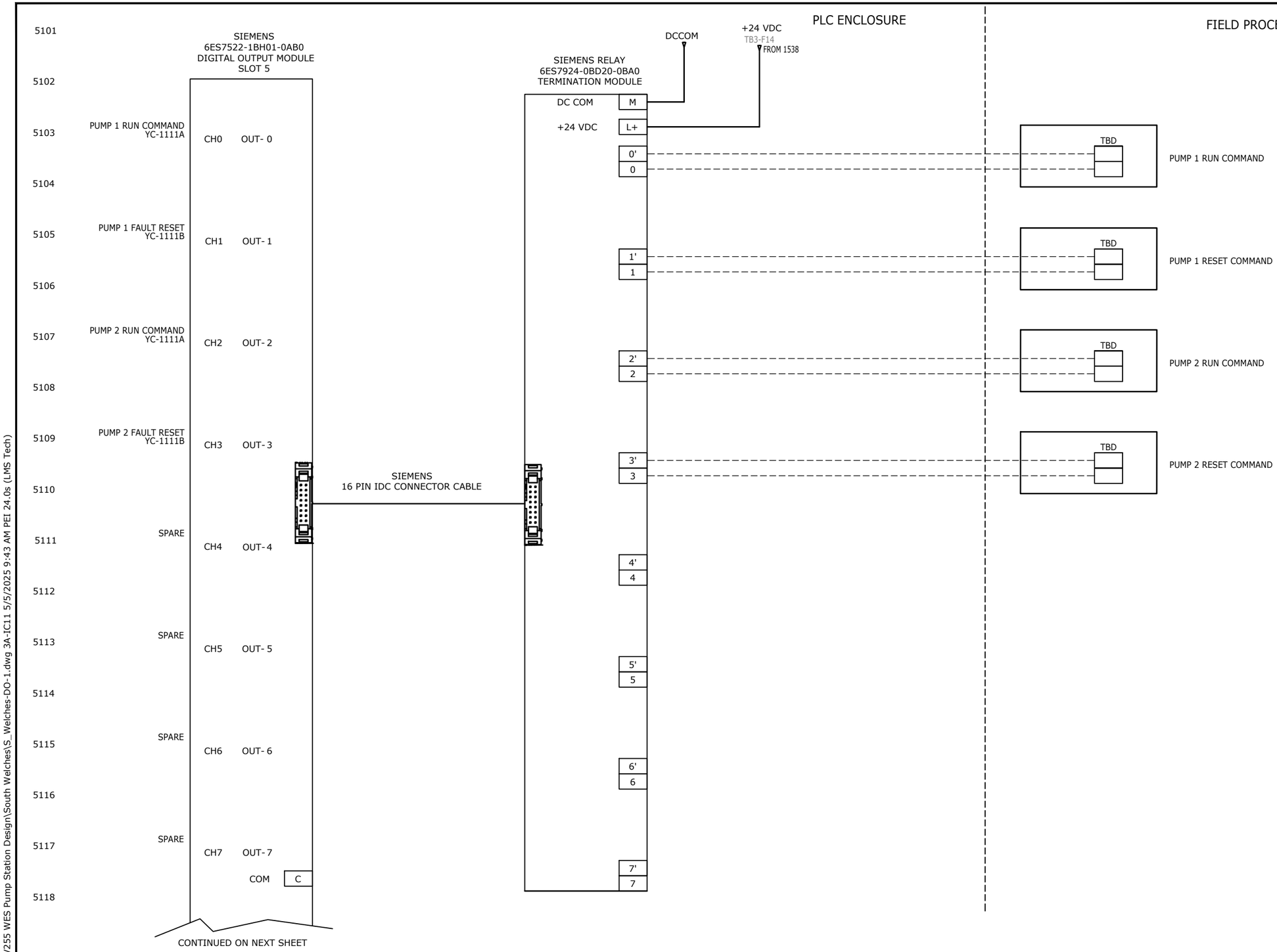
SOUTH WELCHES PUMP STATION
DIGITAL INPUT - 4

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CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3A-IC11 55 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT: HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

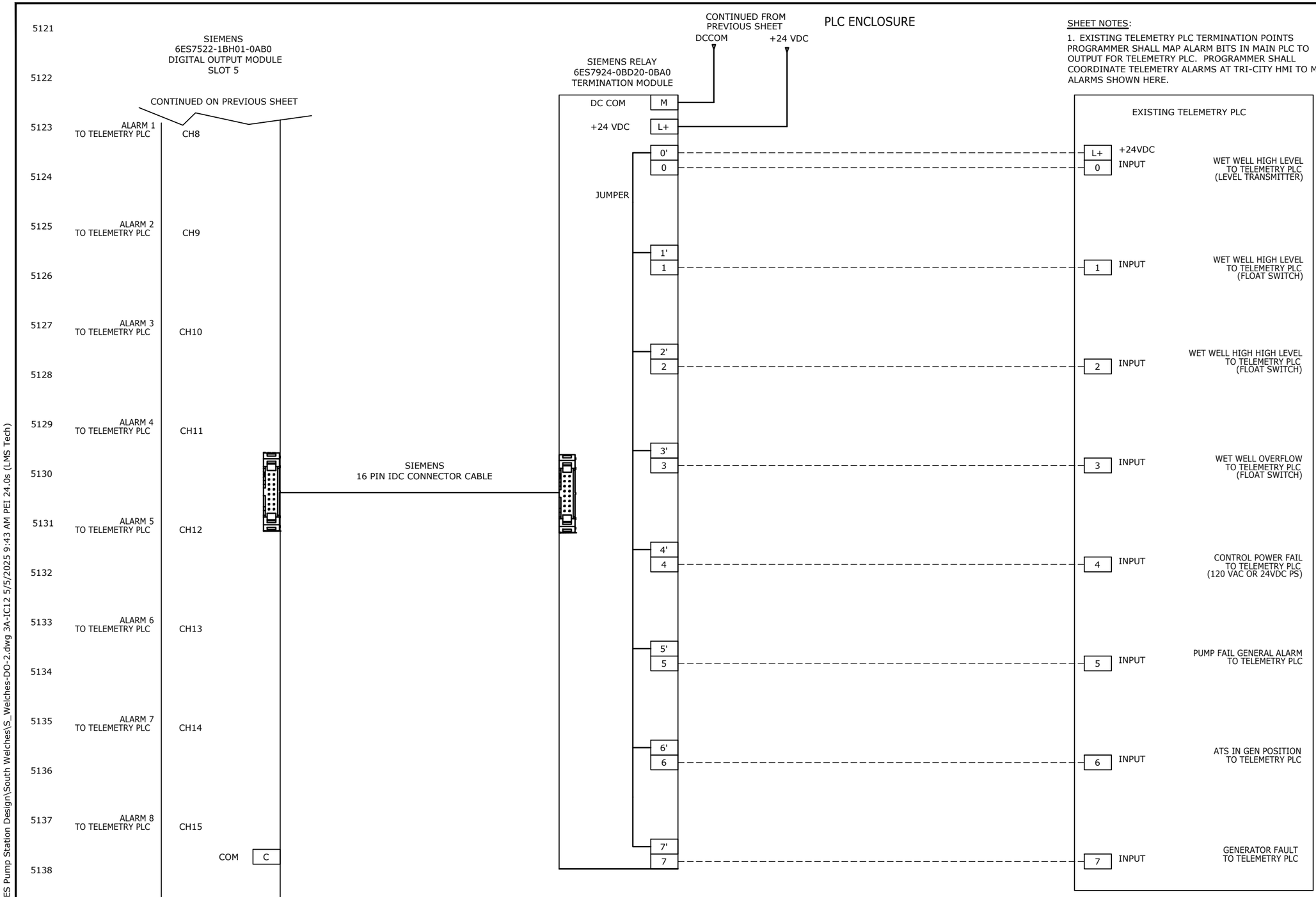
SOUTH WELCHES PUMP STATION
DIGITAL OUTPUT - 1

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

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SHEET NOTES:

1. EXISTING TELEMETRY PLC TERMINATION POINTS PROGRAMMER SHALL MAP ALARM BITS IN MAIN PLC TO OUTPUT FOR TELEMETRY PLC. PROGRAMMER SHALL COORDINATE TELEMETRY ALARMS AT TRI-CITY HMI TO MATCH ALARMS SHOWN HERE.

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

PANEL WIRING
FIELD WIRING
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SPARKS — DEC. 17, 2024 — RENEWAL: 6/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
DIGITAL OUTPUT - 2

SHEET 3A-IC12
56 of 184

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DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

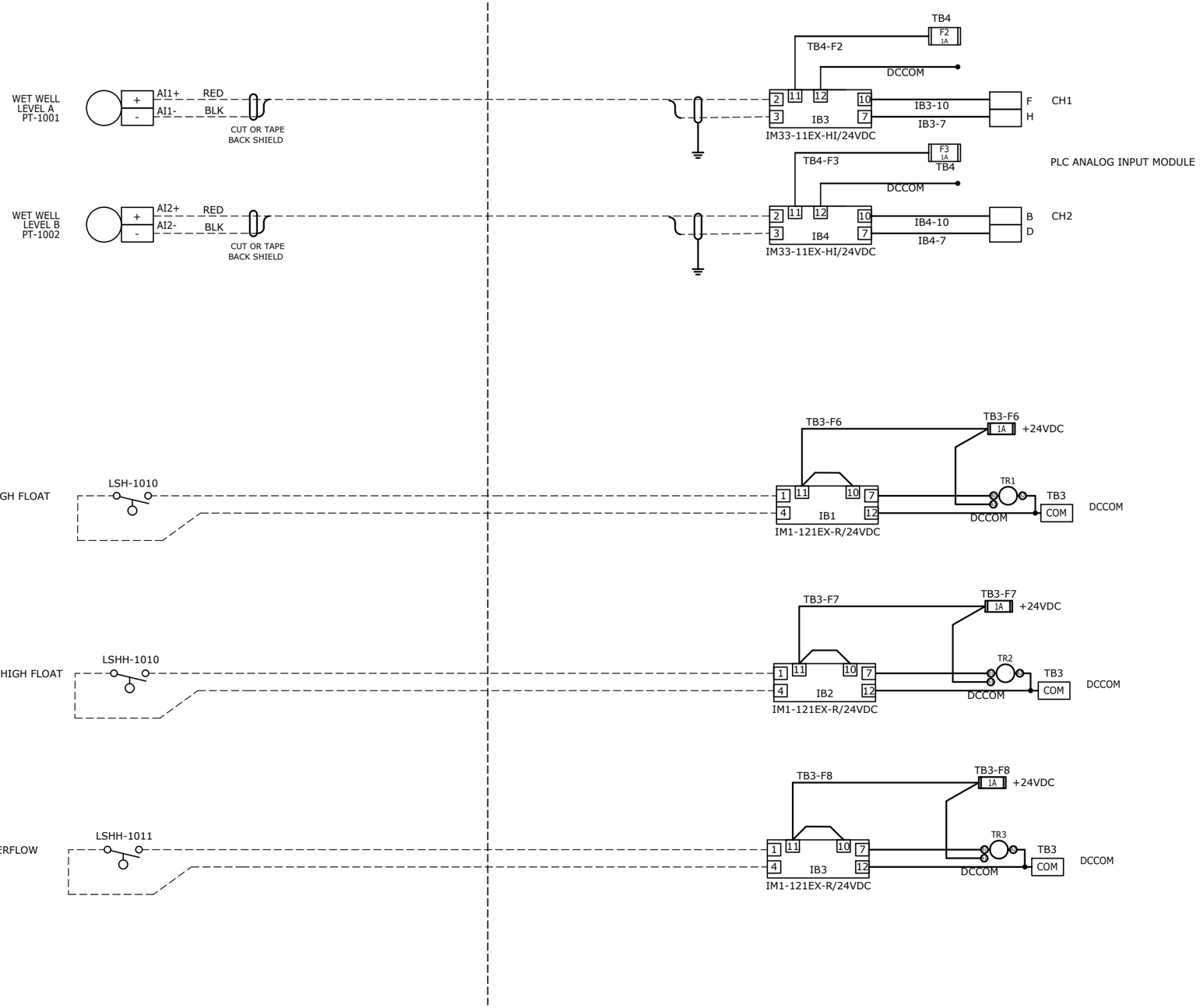
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HAZARDOUS AREA
CLASS 1, DIVISION 1, GROUP D

SAFE AREA

SHEET NOTES:

1. INTRINSICALLY SAFE DETAIL APPLIES TO ANALOG INPUT ON SHEET AI-1. APPLIES TO FLOAT CONTROLS ON SHEET PWR. CERTIFICATION: TURCK IECEx TUN 06.0007X



WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

PANEL WIRING
FIELD WIRING
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

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SHEET 3A-IC13 57 of 184

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CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — JAMES C. YARNELL — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

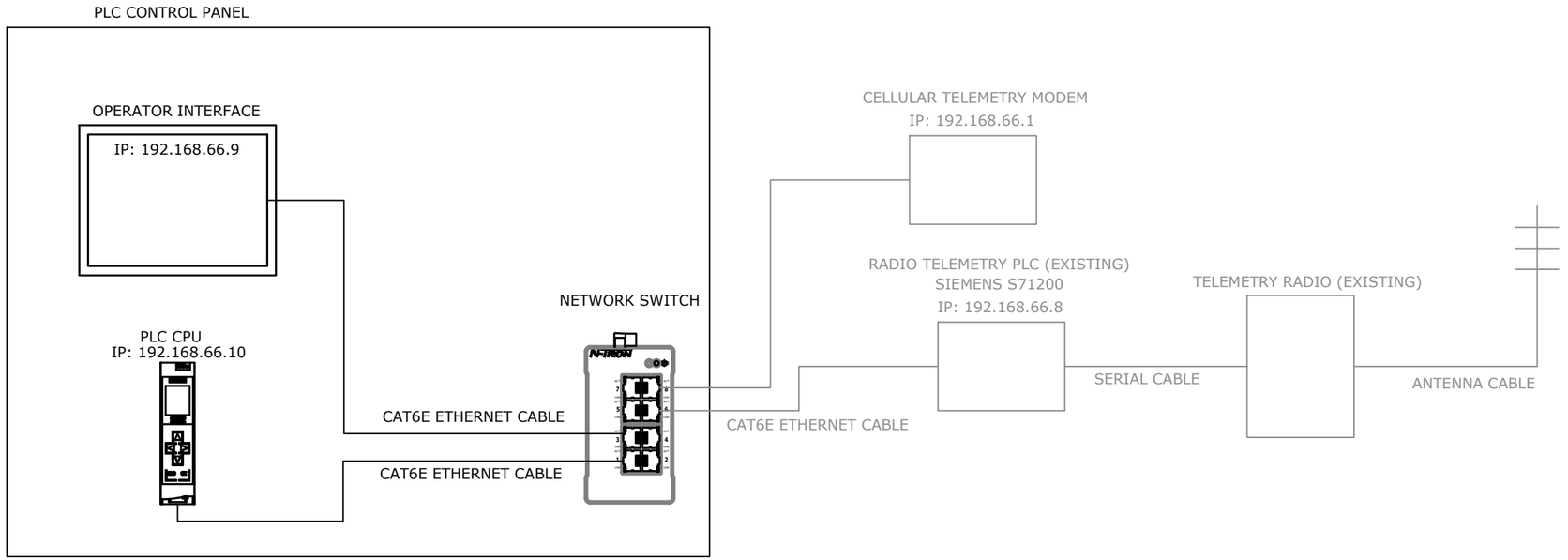
SOUTH WELCHES PUMP STATION
INTRINSIC SAFETY

consor

DATE: MAY 2025
19-2679
PROJECT:

CLACKAMAS WATER ENVIRONMENT SERVICES

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PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3A-IC14 58 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — DEC. 17, 2024 — RENEWAL: 6/30/2026

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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
NETWORK DETAIL

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

SHEET NOTES:

1. PULL BACK AND RE-ROUTE EXISTING ANTENNA WIRES FOR CELLULAR MODEM AND RADIO INTO NEW CONTROL PANEL.



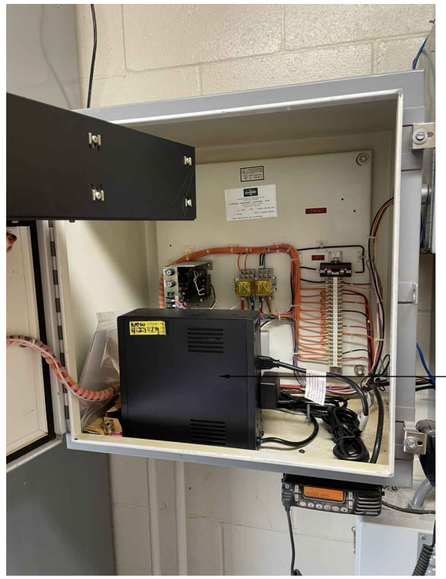
- REMOVE EXISTING TELEMETRY CELLULAR MODEM AND RE-INSTALL ON EXTERNAL TOP OF NEW CONTROL PANEL.
- REMOVE EXISTING RELAY PANEL.
- REMOVE EXISTING ANNUNCIATOR PANEL. SALVAGE AND RE-INSTALL INTERNAL COMPONENTS AS SHOWN ON THIS SHEET DETAIL 3.
- REMOVE EXISTING TELEMETRY PANEL. SALVAGE AND RE-INSTALL INTERNAL COMPONENTS AS SHOWN ON THIS SHEET DETAIL 4.
- REMOVE EXISTING RADIO AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 3A-IC4 FOR INSTALL LOCATION. RE-CONNECT EXISTING ANTENNA CABLE.
- REMOVE EXISTING RADIO POWER SUPPLY PANEL. SALVAGE AND RE-INSTALL INTERNAL COMPONENTS AS SHOWN ON THIS SHEET DETAIL 2.

EXISTING PANEL AND JBOX DEMOLITION 1



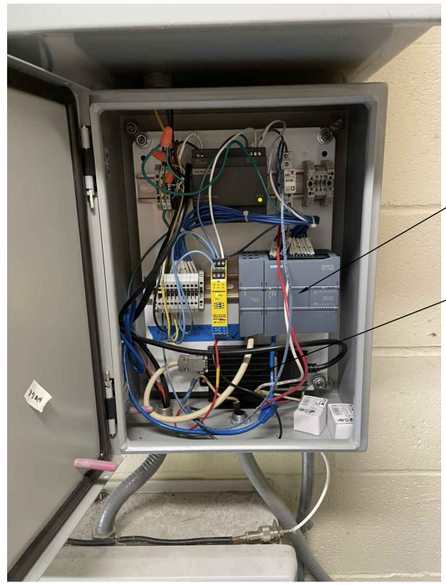
- EXISTING RADIO POWER PANEL: REMOVE RADIO POWER SUPPLY IN THIS PANEL AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 3A-IC4 FOR INSTALL LOCATION.

EXISTING CONTROL PANEL DEMOLITION DETAIL 2



- EXISTING UPS: REMOVE UPS IN THIS PANEL AND PUT IN BOTTOM OF NEW CONTROL PANEL.

EXISTING ANNUNCIATOR PANEL DEMOLITION DETAIL 3



- EXISTING TELEMETRY PANEL: REMOVE S7-1200 PLC IN THIS PANEL AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 3A-IC4 FOR INSTALL LOCATION. SALVAGE ENCLOSURE AND REMAINING PARTS AND RETURN TO WATER ENVIRONMENT SERVICES.
- EXISTING TELEMETRY PANEL: REMOVE SERIAL MODEM AND CABLES IN THIS PANEL AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 3A-IC4 FOR INSTALL LOCATION. SALVAGE ENCLOSURE AND REMAINING PARTS AND RETURN TO WATER ENVIRONMENT SERVICES.

EXISTING TELEMETRY PANEL DEMOLITION DETAIL 4

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3A-IC15
59 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JAMES C. HAPPE — DEC. 17, 2024 — CARL M. WOOD

EXPIRES: 06/30/2026

SCALE
VERT:
HORIZ:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SOUTH WELCHES PUMP STATION
INSTALL AND DEMOLITION DETAIL

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

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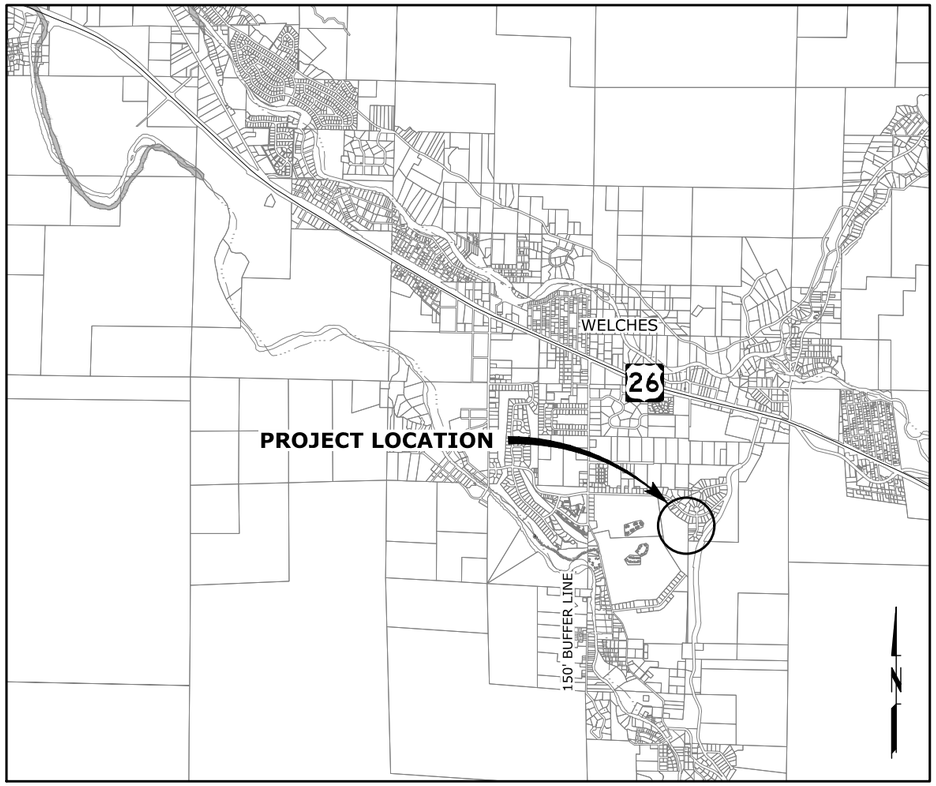
CLACKAMAS
WATER ENVIRONMENT SERVICES

PUMP STATION REHABILITATION AND UPGRADES PROJECT

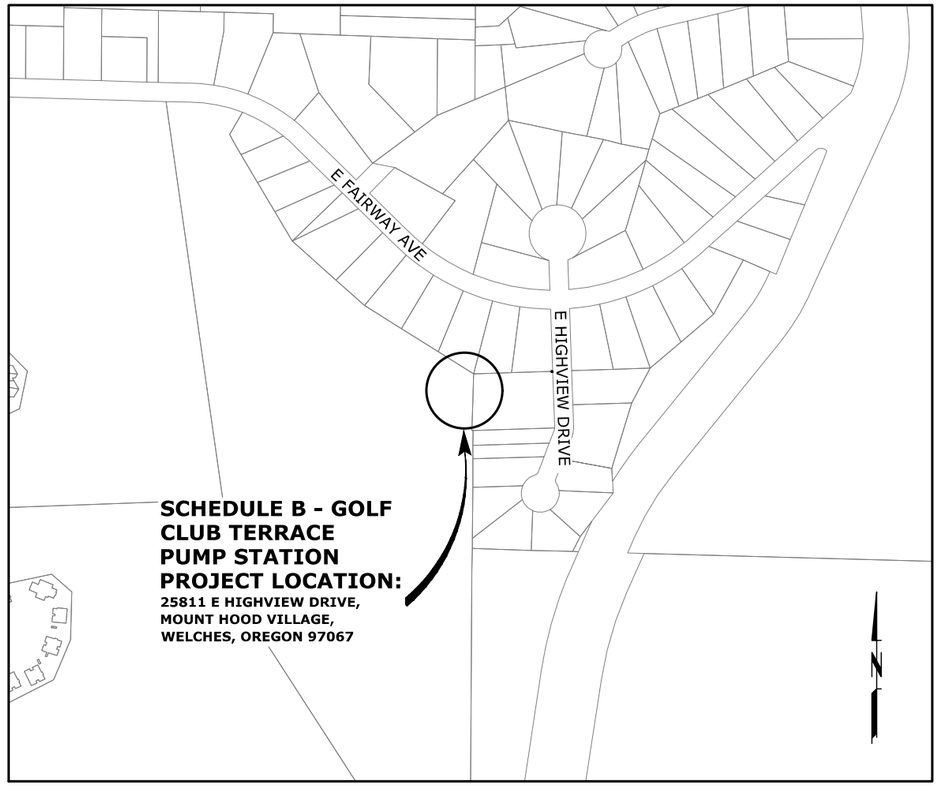
GROUP 3

SCHEDULE B - GOLF CLUB TERRACE PUMP STATION

AUGUST 2024



VICINITY MAP
SCALE: 1"=2,000'



LOCATION MAP
SCALE: 1"=200'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: JCC
CHECKED: EPK
APPROVED: NSL

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98172 — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

SCALE: VERT: AS SHOWN; HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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SHEET 3B-G1 60 of 184

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TERRACE PUMP STATION
COVER SHEET, LOCATION & VICINITY MAP

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

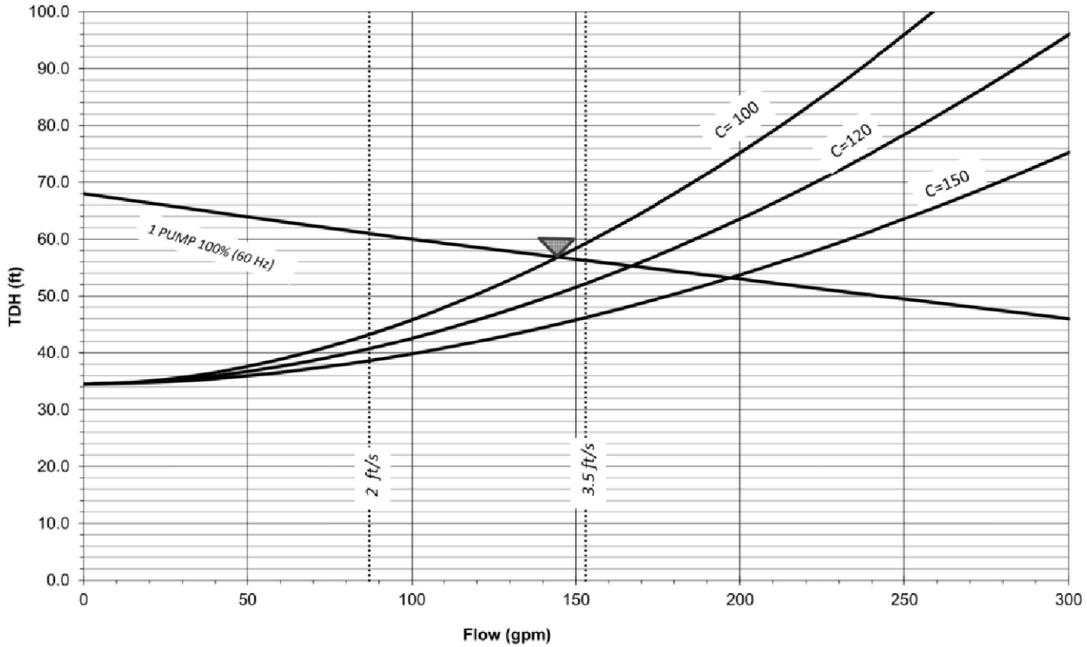
PROJECT: 19-2679 DATE: MAY 2025

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GOLF CLUB TERRACE PUMP STATION AND FORCE MAIN DESIGN DATA TABLE

PUMP STATION	
LOCATION	WEST OF 25811 E HIGHWAY DR, WELCHES, OR, 97067
TYPE	DUPLEX SUBMERSIBLE SEWAGE PUMP STATION WITH CONSTANT SPEED PUMPS
RATED CAPACITY (PER PUMP)	MINIMUM 145 GPM AT 57 FT TDH
FIRM CAPACITY OF PUMP STATION	145 GPM AT 57 FT TDH
MOTOR HORSEPOWER, HP	7.5 HP
PUMP STARTS AT INFLOW = 50% OF THE PUMP CAPACITY	5.0 PER PUMP PER HOUR
WET WELL OPERATIONAL VOLUME	423 GALLONS (PUMPS OFF TO LEAD PUMP ON)
LEVEL CONTROL TYPE	SUBMERSIBLE LEVEL TRANSDUCER (PRIMARY), HIGH LEVEL FLOAT W/ TIMER SHUT-OFF (BACKUP)
ALARM TELEMETRY TYPE	RADIO MODEM W/ PLC, CELLULAR BACKUP
STANDBY POWER TYPE	50 KW PERMANENT DIESEL STANDBY GENERATOR WITH AUTOMATIC TRANSFER SWITCH
FUEL TANK CAPACITY	74 GALLONS, 24 HOUR CAPACITY
OVERFLOW POINT	STATION WET WELL
OVERFLOW ELEVATION	1344.7 FEET
100-YEAR & 500-YEAR FLOOD ELEVATIONS	N/A
EPA RELIABILITY CLASS	1
FORCE MAIN	
TYPE AND LENGTH	1100 FEET OF 4" DIAMETER PVC FORCE MAIN
PROFILE DESCRIPTION	CONTINUOUSLY ASCENDING
AIR RELEASE VALVES	NONE
AVERAGE FORCE MAIN DETENTION TIME	18 MINUTES
DISCHARGE LOCATION	FAIRWAY INTERCEPTOR MANHOLE FW5
SULFIDE CONTROL SYSTEM	NONE

GOLF CLUB TERRACE PUMP STATION SYSTEM HEAD AND PUMP CURVES



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NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: MBE
CHECKED: EPK
APPROVED: NSL

SHEET 3B-G2 61 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98172 — Nicholas Alexander Laferriz — Date: — RENEWS 12-31-26

LICENSED LANDSCAPE ARCHITECT — OREGON — Nicholas Alexander Laferriz — Date: — RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TERRACE PUMP STATION DESIGN DATA TABLE AND SYSTEM CURVE

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

QUALITY ASSURANCE PLAN:

QUALITY ASSURANCE AND CONTROL PLAN:

QUALITY ASSURANCE FOR THE STRUCTURE'S SEISMIC RESISTANCE AND MAIN LATERAL FORCE RESISTING SYSTEM SHALL BE ENSURED BY THE REVIEW OF THE FOLLOWING SUBMITTALS, PERFORMING THE LISTED STRUCTURAL OBSERVATIONS AND IMPLEMENTATION OF THE LISTED SPECIAL INSPECTION AND MATERIAL TESTING OF THE FOLLOWING:

SHOP DRAWINGS AND SUBMITTALS:

SHOP DRAWINGS, CALCULATIONS, SUBMITTALS AND/OR MILL CERTIFICATES FOR THE FOLLOWING ITEMS SHALL BE SUBMITTED TO THE OWNER AND ENGINEER OF RECORD FOR REVIEW A MINIMUM OF 21 DAYS PRIOR TO FABRICATION:

1. CONCRETE MIX DESIGN AND PROPOSED ADMIXTURES
2. CMU REINFORCING SHOP DRAWINGS
3. CMU BLOCK
4. GROUT AND MORTAR MIX DESIGNS
5. STEEL SHOP DRAWINGS
6. CONCRETE REINFORCING SHOP DRAWINGS

SPECIAL INSPECTIONS:

1. SPECIAL INSPECTIONS SHALL CONFORM TO SECTION 1705 OF THE 2021 OSSC, CONTRACT DOCUMENTS AND APPROVED SUBMITTALS. REFER TO SPECIAL INSPECTION AND TESTING TABLES FOR PROJECT REQUIREMENTS.

2. SPECIAL INSPECTIONS AND ASSOCIATED TESTING SHALL BE PERFORMED BY AN APPROVED ACCREDITED INDEPENDENT AGENCY MEETING THE REQUIREMENTS OF ASTM E329 (MATERIALS). THE INSPECTION AND TESTING AGENCY SHALL FURNISH TO THE ENGINEER OF RECORD A COPY OF THEIR SCOPE OF ACCREDITATION. SPECIAL INSPECTORS SHALL BE APPROVED BY THE BUILDING OFFICIAL. WELDING INSPECTORS SHALL BE QUALIFIED PER SECTION 6.1.4.1(1) OF AWS D1.1.

3. THE SPECIAL INSPECTOR SHALL OBSERVE THE INDICATED WORK FOR COMPLIANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS. ALL DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE CONTRACTOR FOR CORRECTION AND NOTED IN THE INSPECTION REPORTS.

4. THE SPECIAL INSPECTOR AND GEOTECHNICAL ENGINEER SHALL FURNISH INSPECTION REPORTS FOR EACH INSPECTION TO THE BUILDING OFFICIAL, STRUCTURAL ENGINEER, ARCHITECT, CONTRACTOR, AND OWNER. THE SPECIAL INSPECTION AGENCY SHALL SUBMIT A FINAL REPORT STATING THAT THE WORK REQUIRING SPECIAL INSPECTION WAS INSPECTED AND IS IN CONFORMANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS AND THAT ALL DISCREPANCIES NOTED IN THE INSPECTION REPORTS HAVE BEEN CORRECTED.

5. QUALITY ASSURANCE (QA) IS REQURIED FOR STRUCTURAL STEEL ITEMS PER AISC 360 AND 341 UNLESS SPECIFICALLY NOTED OTHERWISE. QUALITY CONTROL (QC) TO BE PROVIDED BY THE FABRICATOR, ERECTOR OR OTHER RESPONSIBLE CONTRACTOR AS APPLICABLE. CONTRACTOR AND SPECIAL INSPECTOR TO DOCUMENT QUALITY CONTROL AS REQUIRED IN AISC 360 SECTION N3 AND AISC 341 SECTION J2.

6. INSPECTION TYPES:
   - 6.1. CONTINUOUS : THE FULL-TIME OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK IS BEING PERFORMED.
   - 6.2. PERIODIC : THE PART-TIME OR INTERMITTENT OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK HAS BEEN OR IS BEING PERFORMED AND AT THE COMPLETION OF THE WORK.
   - 6.3. OBSERVE : OBSERVE THESE FUNCTIONS ON A RANDOM, DAILY BASIS. OPERATIONS NEED NOT BE DELAYED PENDING OBSERVATIONS.
   - 6.4. PERFORM : INSPECTIONS SHALL BE PERFORMED PRIOR TO THE FINAL ACCEPTANCE OF THE ITEM.

7. PERFORM INSPECTION PRIOR TO FINAL ACCEPTANCE OF THE ITEM FOR TEN WELDS TO BE MADE BY A GIVEN WELDER, WITH THE WELDER DEMONSTRATING UNDERSTANDING OF REQUIREMENTS AND POSSESSION OF SKILLS AND TOOLS TO VERIFY THESE ITEMS, THE PERFORM DESIGNATION OF THIS TASK SHALL BE REDUCED TO OBSERVE, AND THE WELDER SHALL PERFORM THIS TASK. SHOULD THE INSPECTOR DETERMINE THAT THE WELDER HAS DISCONTINUED PERFORMANCE OF THIS TASK, THE TASK SHALL BE RETURNED TO PERFORM UNTIL SUCH TIME AS THE INSPECTOR HAS RE-ESTABLISHED ADEQUATE ASSURANCE THAT THE WELDER WILL PERFORM THE INSPECTION TASKS LISTED.

8. SPECIAL INSPECTION OF MECHANICAL POST INSTALLED ANCHORS SHALL BE IN STRICT CONFORMANCE WITH THE ICC REPORT AND MANUFACTURER'S INSTALLATION REQUIREMENTS. ANCHOR INSTALLERS SHALL BE QUALIFIED AS REQUIRED BY JURISDICTION REQUIREMENTS.
   - 8.1. INSPECTION REPORTS SHALL IDENTIFY NAMES OF INSTALLERS.
   - 8.2. SPECIAL INSPECTOR SHALL PROVIDE DOCUMENTATION AT THE END OF ANCHOR INSTALLATIONS STATING THAT THE ANCHORS WERE INSPECTED PER APPROVED ANCHOR EVALUATION REPORT.

9. TESTING ABBREVIATIONS:
   - 9.1. NDT - NON-DESTRUCTIVE TESTING
   - 9.2. C.J.P. - COMPLETE JOINT PENETRATION
   - 9.3. MT - MAGNETIC PARTICLE TESTING
   - 9.4. RBS - REDUCED BEAM SECTION

10. DOCUMENT (D): INDICATES CONTRACTOR AND SPECIAL INSPECTOR TO PROVIDE DOCUMENTATION IN ACCORDANCE WITH AISC 341.

STRUCTURAL OBSERVATION REQUIREMENTS:

1. THE OWNER SHALL EMPLOY THE ENGINEER OF RECORD OR AN ALTERNATE OREGON LICENSED PROFESSIONAL ENGINEER, APPROVED BY THE ENGINEER OF RECORD, TO PERFORM STRUCTURAL OBSERVATIONS IN ACCORDANCE WITH SECTION 1704.6 OF THE INTERNATIONAL BUILDING CODE.

2. STRUCTURAL OBSERVATION IS THE VISUAL OBSERVATION OF THE STRUCTURAL SYSTEM BY A REGISTERED DESIGN PROFESSIONAL FOR GENERAL CONFORMANCE TO THE APPROVED CONSTRUCTION DOCUMENTS AT SIGNIFICANT CONSTRUCTION STAGES AND AT COMPLETION OF THE STRUCTURAL SYSTEM. STRUCTURAL OBSERVATION DOES NOT INCLUDE OR WAIVE THE RESPONSIBILITY FOR ANY OTHER INSPECTION CRITERIA, INCLUDING SPECIAL INSPECTION, AS REQUIRED BY THE BUILDING OFFICIAL OR AS INDICATED WITHIN THE INTERNATIONAL BUILDING CODE.

3. DEFICIENCIES SHALL BE REPORTED IN WRITING TO THE OWNER AND THE BUILDING OFFICIAL (AND THE ENGINEER OF RECORD IF AN ALTERNATE ENGINEER IS USED FOR STRUCTURAL OBSERVATION). AT THE CONCLUSION OF THE STRUCTURAL WORK INCLUDED WITHIN THE PERMIT, THE STRUCTURAL OBSERVER SHALL SUBMIT TO THE BUILDING OFFICIAL AND THE OWNER (AND THE ENGINEER OF RECORD IF AN ALTERNATE ENGINEER IS USED FOR STRUCTURAL OBSERVATION) A WRITTEN STATEMENT THAT THE SITE VISITS HAVE BEEN MADE AND IDENTIFY ANY REPORTED DEFICIENCIES WHICH, TO THE BEST OF THE STRUCTURAL OBSERVER'S KNOWLEDGE, HAVE NOT BEEN RESOLVED.

4. THE CONTRACTOR SHALL MAKE AVAILABLE ALL MEANS AND METHODS NECESSARY FOR THE STRUCTURAL OBSERVER TO PERFORM THE REQUIRED STRUCTURAL OBSERVATIONS. IN ADDITION, THE CONTRACTOR SHALL NOTIFY THE OWNER AND STRUCTURAL OBSERVER A MINIMUM OF 48 HOURS BEFORE THE TIME AT WHICH THE SPECIFIED STRUCTURAL OBSERVATIONS MAY BE PERFORMED. IN ADDITION THE CONTRACTOR SHALL UPDATE THE STRUCTURAL OBSERVER OF THE CONSTRUCTION PROGRESS.

5. STRUCTURAL OBSERVATIONS SHALL BE PERFORMED FOR THE FOLLOWING AREAS OF WORK:
   - 5.1. FORMING AND REINFORCING THE FOUNDATION AND SLAB ON GRADE
   - 5.2. CMU WALL CONSTRUCTION AND REINFORCING, PRIOR TO THE FIRST GROUT POUR
   - 5.3. CONSTRUCTION OF CMU LINTEL, PRIOR TO GROUT POUR
   - 5.4. FOLLOWING THE INSTALLATION OF ROOF FRAMING, PRIOR TO THE INSTALLATION OF FINISHES
   - 5.5. FOLLOWING THE COMPLETION OF ALL STRUCTURAL ELEMENTS CONTAINED HEREIN.

GENERAL - SPECIAL INSPECTIONS

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6)		REMARKS
			CONTINUOUS	PERIODIC	
DEFERRED SUBMITTALS				X	SPECIAL INSPECTION REQUIREMENTS FOR DEFERRED SUBMITTAL ITEMS, INCLUDING REQUIREMENTS FOR DESIGNATED SEISMIC SYSTEMS IN ACCORDANCE WITH OSSC SECTION 1705.12.4 IF APPLICABLE, TO BE SPECIFIED BY THE SYSTEM ENGINEER AND INCLUDED WITH DEFERRED SUBMITTAL DOCUMENTS.
SUBMITTALS TO THE BUILDING OFFICIAL	1704.5			X	CERTIFICATES OF COMPLIANCE, REPORTS OF PRE-CONSTRUCTION TESTS, OR REPORTS OF MATERIAL PROPERTIES SHALL BE SUBMITTED TO THE BUILDING OFFICIAL.
POST INSTALLED MECHANICAL ANCHORS AND ADHESIVE ANCHORS IN HARDENED CONCRETE AND COMPLETED MASONRY				X	

SOILS/GEOTECHNICAL - SPECIAL INSPECTIONS

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARDS REFERENCE	FREQUENCY (NOTE 6)		REMARKS
			CONTINUOUS	PERIODIC	
SOILS					
VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY	1705.6			X	BY THE GEOTECHNICAL ENGINEER OR QUALIFIED SPECIAL INSPECTOR
VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL				X	
PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS				X	
VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF COMPACTED FILL			X		
PRIOR TO PLACEMENT OF COMPACTED FILL, INSPECT SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY				X	

SOILS/GEOTECHNICAL - TESTING

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6)		REMARKS
			CONTINUOUS	PERIODIC	
FILL IN-PLACE DENSITY OR PREPARED SUBGRADE DENSITY	1705.6	GEOTECHNICAL REPORT		X	BY THE QUALIFIED SPECIAL INSPECTOR
MATERIAL VERIFICATION		VARIES; CLASSIFICATION AND TESTING OF CONTROLLED FILL MATERIALS		X	BY THE QUALIFIED SPECIAL INSPECTOR
TEST ELEMENTS	1705.6 1705.7		REFERENCE SPECIFICATIONS FOR PERFORMANCE VERIFICATION AND PROOF LOAD TESTING REQUIREMENTS		BY THE QUALIFIED SPECIAL INSPECTOR

CONCRETE - SPECIAL INSPECTION

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6)		REMARKS
			CONTINUOUS	PERIODIC	
GENERAL	1705.3 1901.6	ACI 318: 26.13			SPECIAL INSPECTIONS OF CONCRETE SHALL CONFORM TO THE REQUIREMENTS OF SECTION 1705.3 OF THE IBC AND SECTION 26.13 OF ACI 318.
REINFORCING STEEL PLACEMENT	1901.5.2 1908.1	"ACI 318: CH. 20, 25.2, 25.3, 26.6.1-26.6.3, 26.13.3.3"		X	REINFORCING TO COMPLY WITH ALL CODE PROTECTION, SPACING AND TOLERANCE LIMITS.
INSPECT ANCHORS/BOLTS CAST IN CONCRETE	-	ACI 318: 26.13	X	X	ALL CAST-IN-PLACE ANCHORS/BOLTS SHALL BE VISUALLY INSPECTED. REFERENCE STEEL INSPECTIONS FOR ADDITIONAL INSTALLATION, MATERIAL AND WELDING INSPECTIONS OF STEEL ITEMS EMBEDDED IN CONCRETE (HEADED STUDS, DBA's, ETC.)
VERIFYING USE OF REQUIRED MIX DESIGN(S)	1904.1 1904.2	ACI 318: CH. 19, 26.4.3, 26.4.4		X	
CONCRETE SPECIMENS FOR TESTING		ASTM C172 ASTM C31 ACI 318: 26.5, 26.12	X		PRIOR TO CONCRETE PLACEMENT, FABRICATE CONCRETE SPECIMENS FOR TESTING. SEE THE CONCRETE TESTING TABLE FOR ADDITIONAL INFORMATION.
CONCRETE PLACEMENT, NON-SHRINK GROUT		ACI 318: 26.5, 26.13.3.2	X		
CONCRETE CURING		ACI 318: 26.5.3 - 26.5.5, 26.13.3.3		X	VERIFY MAINTENANCE OF SPECIFIED CURING TEMPERATURES AND TECHNIQUES
VERIFICATION OF FORMWORK		ACI 318: 26.11.1.2(b), 26.13.3.3		X	SPECIAL INSPECTIONS APPLY TO SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED

CONCRETE - TESTING

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6)	REMARKS
CONCRETE STRENGTH	1705.3 ASTM C172 ASTM C 31 ACI 318 26.12 ACI 318 26.5	ASTM C39	EACH 150 CY NOR LESS THAN EACH 5000 SF OF SLAB OR WALL PLACED EACH SHIFT	FABRICATE SPECIMENS AT TIME FRESH CONCRETE IS PLACED
CONCRETE SLUMP		ASTM C143		
CONCRETE AIR CONTENT		ASTM C231		
CONCRETE TEMPERATURE		ASTM C1064		

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PSE PETERSON STRUCTURAL ENGINEERS

NO. | DATE | REVISION | BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3B-G3
62 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2021 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE VERT.: AS SHOWN HORIZ: AS SHOWN

NOTICE 0 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
STRUCTURAL QUALITY ASSURANCE PLAN - 1

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Updated Drawings\2025_05_05_05 Group 3 Final Drawings R2 1901-0206.dwg 3B-G3 5/6/2025 2:11 PM SAMRICHMANN 24.2s (LMS Tech)

MASONRY MINIMUM VERIFICATION REQUIREMENTS

MINIMUM VERIFICATION	QUALITY ASSURANCE LEVEL 3	CODE REFERENCE TMS 602-16 Table 3 (S-25)	REMARKS
PRIOR TO CONSTRUCTION, VERIFICATION OF COMPLIANCE OF SUBMITTALS.	R	ART. 1.5	
PRIOR TO CONSTRUCTION VERIFICATION OF f'm AND f'AAC, EXCEPT WHERE SPECIFICALLY EXEMPTED BY THE CODE.	R	ART. 1.4 B	
DURING CONSTRUCTION, VERIFICATION OF SLUMP FLOW AND VISUAL STABILITY INDEX (VSI) WHEN SELF-CONSOLIDATING GROUT IS DELIVERED TO THE PROJECT SITE.	R	ART. 1.5 & 1.6.3	
DURING CONSTRUCTION, VERIFICATION OF f'm AND f'AAC FOR EVERY 5,000 SQ. FT.	R	ART. 1.4 B	
DURING CONSTRUCTION, VERIFICATION OF PROPORTIONS OF MATERIALS AS DELIVERED TO THE PROJECT SITE FOR PREMIXED OR PREBLENDED MORTAR, PRESTRESSING GROUT, AND GROUT OTHER THAN SELF-CONSOLIDATING GROUT.	R	ART. 1.4 B	
NOTE: R=REQUIRED, NR=NOT REQUIRED (SEE NOTE 6)			

MASONRY MINIMUM SPECIAL INSPECTION REQUIREMENTS

INSPECTION TASK	QUALITY ASSURANCE LEVEL 3	CODE REFERENCE TMS 402-16	CODE REFERENCE TMS 602-16 Table 4 (S-26)	REMARKS
1. AS MASONRY CONSTRUCTION BEGINS, VERIFY THAT THE FOLLOWING ARE IN COMPLIANCE:				
A. PROPORTIONS OF SITE-PREPARED MORTAR	P		ART. 2.1, 2.6 A, & 2.6 C	
B. GRADE AND SIZE OF PRESTRESSING TENDONS AND ANCHORAGES	P		ART. 2.4 B & 2.4 H	
C. GRADE, TYPE, AND SIZE OF REINFORCEMENT AND ANCHOR BOLTS, AND PRESTRESSING TENDONS AND ANCHORAGES	P		ART 3.4 & 3.6 A	
2. PRIOR TO GROUTING, VERIFY THAT THE FOLLOWING ARE IN COMPLIANCE:				
A. GROUT SPACE	C		ART. 3.2 D & 3.2 F	
C. PLACEMENT OF REINFORCEMENT, CONNECTORS, AND ANCHOR BOLTS	C	SEC. 6.1, 6.3.1, 6.3.6 &6.3.7	ART. 3.2 E & 3.4	REFERENCE THE GENERAL TABLE FOR SPECIAL INSPECTION REQUIRED FOR POST INSTALLED ANCHORS INTO COMPLETED MASONRY.
D. PROPORTIONS OF SITE-PREPARED GROUT	P		ART. 2.6 B & 2.4 G.1.b	
3. VERIFY COMPLIANCE OF THE FOLLOWING DURING CONSTRUCTION:				
A. MATERIALS AND PROCEDURES WITH THE APPROVED SUBMITTALS	P		ART. 1.5	
B. PLACEMENT OF MASONRY UNITS AND MORTAR JOINT CONSTRUCTION	P		ART. 3.3 B	
C. SIZE AND LOCATION OF STRUCTURAL MEMBERS	P		ART. 3.3 F	
D. TYPE, SIZE AND LOCATION OF ANCHORS, INCLUDING OTHER DETAILS OF ANCHORAGE OF MASONRY TO STRUCTURAL MEMBERS, FRAMES, OR OTHER CONSTRUCTION	C	SEC. 1.2.1 (e), 6.2.1 & 6.3.1		
F. PREPARATION, CONSTRUCTION, AND PROTECTION OF MASONRY DURING COLD WEATHER (TEMPERATURE BELOW 40 F) OR HOT WEATHER (TEMPERATURE ABOVE 90 F)	P		ART. 1.8 C & 1.8 D	
4. OBSERVE PREPARATION OF GROUT SPECIMENS, MORTAR SPECIMENS, AND/ OR PRISMS	C		ART. 1.4 B.2.a.3, 1.4 B.2.b.3, 1.4 B.2.c.3, 1.4 B.3 & 1.4 B.4	
NOTE: R=REQUIRED, NR=NOT REQUIRED, P=PERIODIC, C=CONTINUOUS (NOTE 6)				

MASONRY- REQUIRED TESTING

SYSTEM OR MATERIAL	OSSC CODE REFERENCE OR REFERENCED STANDARD	REMARKS
UNIT STRENGTH METHOD-MASONRY UNIT	1705.4 TMS 602 1.4.B TMS 602.2.3 TMS 602 2.3 E ASTM REFERENCES PER REMARKS	CONCRETE MASONRY (ASTM C90) CONCRETE MASONRY UNIT MATERIALS TO CONFORM TO ASTM C55, C73, C90, C129, C744, OR C1634 AS SPECIFIED. CLAY MASONRY (ASTM C62, ASTM C216, OR ASTM C652). CLAY OR SHALE MASONRY UNITS TO CONFORM TO ASTM C34, C56, C62, C126, C212, C216, C652, C1088, OR C1405 OR TO ANSI A 137.1 AS SPECIFIED. AAC MASONRY UNITS TO CONFORM TO ASTM C1691 AND ASTM C1693.
UNIT STRENGTH METHOD-COMPRESSIVE STRENGTH OF MORTAR	1705.4 TMS 602 2.1 , ASTM C270	MORTAR SHALL COMPLY WITH ASTM C270 . FOR AAC (ASTM C1660)
UNIT STRENGTH METHOD-COMPRESSIVE STRENGTH OF GROUT	1705.4 TMS 602 2.2, ASTM C476	GROUT SHALL COMPLY WITH ASTM C476. WHEN f'm EXCEEDS 2,000 PSI PROVIDE COMPRESSIVE STRENGTH THAT EQUALS OR EXCEEDS f'm. DETERMINE COMPRESSIVE STRENGTH OF GROUT IN ACCORDANCE WITH ASTM C1019. DO NOT USE ADMIXTURES UNLESS ACCEPTABLE. FIELD ADDITION OF ADMIXTURES IS NOT PERMITTED IN SELF-CONSOLIDATING GROUT.
PRISM TEST METHOD	1705.4 TMS 602 1.4 B.2.3, 1.4 B.4, ASTM C1314	FOR BOTH CLAY AND CONCRETE MASONRY, TEST IN ACCORDANCE WITH ASTM C1314. DETERMINE LENGTH, WIDTH AND HEIGHT DIMENSIONS OF THE PRISM AND TEST PRISMS WHEN AT LEAST 28 DAYS OLD IN ACCORDANCE WITH ASTM C1314.
TESTING PRISMS FROM CONSTRUCTED MASONRY	1705.4 TMS 602 1.4 B 4.a, 1.4 B 4.b, 1.4 B 4.c, ASTM C1532	PRISM SAMPLING AND REMOVAL- FOR EACH 5000 SQUARE FEET OF WALL AREA IN QUESTION, SAW-CUT A MINIMUM OF THREE PRISMS FROM COMPLETED MASONRY. SELECT, REMOVE, AND TRANSPORT PRISMS PER ASTM C1532/C1532M.
General Notes: 1.4 B.1 or 1.4 B.2 Either the Unit Strength Method or the Prism Test Method may be chosen to satisfy special inspections compressive strength for each wythe.		

STEEL - SPECIAL INSPECTIONS

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6) CONTINUOUS	FREQUENCY (NOTE 6) PERIODIC	REMARKS
STEEL FABRICATION - REQUIRED STRUCTURAL SPECIAL INSPECTIONS					
FABRICATION OF STRUCTURAL ELEMENTS	1704.2.5.1	AISC 360		X	REFER TO INSPECTION OF FABRICATOR REQUIREMENTS
MATERIAL VERIFICATION OF STRUCTURAL STEEL COMPONENTS	1505.2.1 2203.1 TABLE 1705.2	ASTM A6 ASTM STANDARDS SPECIFIED IN CONSTRUCTION DOCUMENTS AISC 360 A3.1 AISC 360 N3.2		X	CERTIFIED MILL TEST REPORTS
MATERIAL VERIFICATION OF HIGH STRENGTH BOLTS, NUTS, AND WASHERS	1705.2.1.2 AISC 360 N5 TABLE 1705.2-2	AISC 360 A3.3 AISC 360 N3.2 ASTM STANDARDS SPECIFIED IN CONSTRUCTION DOCUMENTS RCSC 2.1		X	MANUFACTURER'S CERTIFIED TEST REPORTS
MATERIAL VERIFICATION OF ANCHOR BOLTS AND THREADED RODS		AISC 360 A3.4 AISC 360 N3.2 ASTM STANDARDS SPECIFIED IN CONSTRUCTION DOCUMENTS		X	MANUFACTURER'S CERTIFIED TEST REPORTS
MATERIAL VERIFICATION OF WELD FILLER METALS	1705.2.1.1 TABLE 1705.2-5	AISC 360 A3.5 AISC 360 N3.2 APPLICABLE AWS A5 DOCUMENTS		X	MANUFACTURER'S CERTIFIED TEST REPORTS
STRUCTURAL STEEL WELDING - REQUIRED STRUCTURAL SPECIAL INSPECTIONS					
VERIFYING USE OF PROPER WPS'S	1705.2.1 AWS D1.1	AISC 360 N3.2			RETAIN A RECORD OF WELDING PROCEDURE SPECIFICATIONS
VERIFYING WELDER QUALIFICATIONS		AWS D1.1		X	RETAIN A RECORD OF QUALIFICATION CARDS
SINGLE PASS FILLET WELDS LESS THAN OR EQUAL TO 5/16"				X	

REQUIRED SPECIAL INSPECTIONS for SEISMIC RESISTANCE

SYSTEM or MATERIAL	INSPECTION: IBC CODE REFERENCE	INSPECTION: CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6): Continuous	FREQUENCY (NOTE 6): Periodic	REMARKS
ARCHITECTURAL COMPONENTS					
INSTALLATION OF ANCHORAGE OF STORAGE RACKS 8 FEET OR GREATER IN HEIGHT IN STRUCTURES	1705.13.7 TABLE 1705.13.7	ASCE 7-16 Section 15.5.3		X	
INSTALLATION OF OTHER SEISMIC SUPPORTS FOR ARCHITECTURAL SYSTEMS AND THEIR COMPONENTS	1705.13.5			X	

LIGHT GAUGE AND OTHER STEEL - SPECIAL INSPECTIONS

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6) CONTINUOUS	FREQUENCY (NOTE 6) PERIODIC	REMARKS
GENERAL					
IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS	1705.2.2 1705.2.3 1705.2.4 TABLE 1705.2-4	APPLICABLE ASTM STANDARDS		X	MANUFACTURER'S CERTIFIED TEST REPORTS
COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION: REQUIRED SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE					
SCREW ATTACHMENT, BOLTING, ANCHORING AND OTHER FASTENING OF ELEMENTS OF THE SEISMIC-FORCE-RESISTING SYSTEM, INCLUDING SHEAR WALLS, BRACES, DIAPHRAGMS, COLLECTORS (DRAG STRUTS) AND HOLD-DOWNS	1705.12.3	AWS D1.3		X	EXCEPTION: NOT REQUIRED FOR SHEAR WALLS, BRACES, DIAPHRAGMS, DRAG STRUT AND HOLD-DOWNS. IF SHEATHING IS GYP OR FIBERBOARD OR IF SHEATHING IS WOOD STRUCTURAL PANEL/STEEL SHEET ONE SIDE ONLY AND FASTENER SPACING IS GREATER THAN 4" ON CENTER

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PSE PETERSON STRUCTURAL ENGINEERS

NO. | DATE | REVISION | BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3B-G4
63 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2021 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE | VERT.: AS SHOWN | HORIZ.: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
STRUCTURAL QUALITY ASSURANCE PLAN - 2

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Group 3 Final Drawings R2 1901-0206.dwg 3B-G4 5/6/2025 2:11 PM SAMRICHMANN 24.2s (LMS Tech)

FENCE POINT TABLE			
NO.	DESC	NORTHING	EASTING
1	NORTH CORNER	612048.4466	7828484.2468
2	NORTHWEST CORNER	612034.2077	7828473.7090
3	NORTHWEST CORNER 2	612035.0863	7828445.6027
4	SOUTHWEST CORNER	611988.2067	7828444.1374
5	SOUTHEAST CORNER	611986.7513	7828506.7025
6	NORTHEAST CORNER	612032.2880	7828516.6796

SEDIMENT FENCE 4-23 / 3-GD1

STRAW WATTLES 4-27 / 3-GD1

EXIST CTRL BUILDING

EXIST LIGHT AND RADIO POLE

EXIST VALVE VAULT

EXIST WET WELL

EXIST CL FENCE

EXIST INFLUENT MH

4"SSFM

8"SS

SS-8

1342

1343

1344

3/4"W

E

PLAN
SCALE: 1"=5'

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH B-C.dwg 3B-C1 8/27/2024 12:55 PM ANTHONY.DEPAUL 24.1s (LMS Tech)

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-C1 64 of 184

OREGON 98172 PROFESSIONAL ENGINEER Nicholas S. Laferriere Date: 12/31/26

OREGON 98172 LICENSED LANDSCAPE ARCHITECT Nicholas S. Laferriere Date: 12/31/26

RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
SITE PREPARATION
AND EROSION CONTROL

consor

DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabiltation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH B-C.dwg 3B-C2 8/27/2024 12:55 PM ANTHONY.DEPAUL 24.1s (LMS Tech)

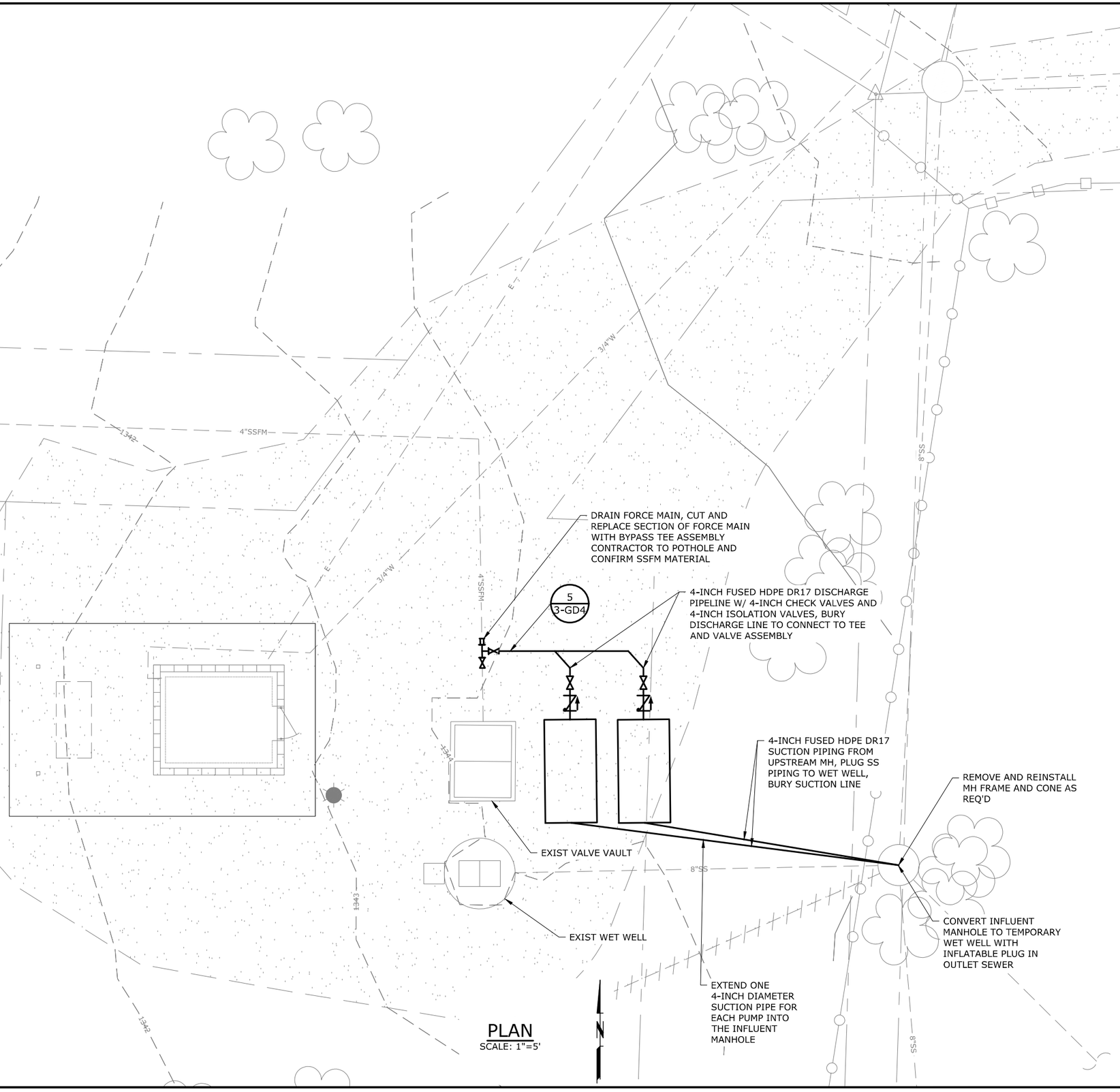
SHEET NOTES:

1. DESIGN, INSTALL, AND MAINTAIN BYPASS PUMPING SYSTEM TO MAINTAIN FLOWS AT ALL TIME PER SECTION 01 57 19.11.

2. BYPASSING PLAN IS SCHEMATIC AND NOT INTENDED TO SHOW ALL REQUIREMENTS OR ACTUAL PLACEMENT OF EQUIPMENT AND PIPING.

3. COORDINATED BYPASSING INSTALLATION WITH WORK SEQUENCING PER SECTION 01 12 16.

3. RESTORE SITE SURFACING AND GRADES FOLLOWING REMOVAL OF BYPASSING EQUIPMENT.



PLAN
SCALE: 1"=5'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-C2 65 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98172 — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

REGISTERED LANDSCAPE ARCHITECT — OREGON — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
BYPASS PUMPING PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH B-C.dwg 3B-C3 8/27/2024 12:55 PM ANTHONY.DEPAUL 24.1s (LMS Tech)

SEE 3B-E SHEETS FOR OVERHEAD POWER REMOVAL

ABANDON EXIST ¾" WATER SERVICE IN PLACE

REMOVE AND DISPOSE OF EXIST GATE

REMOVE AND DISPOSE OF FENCE SECTION

REMOVE TREES, TYP OF 11

REMOVE AND DISPOSE OF EXIST VALVE VAULT

REMOVE AND DISPOSE OF MH TOP CONE

REMOVE AND DISPOSE OF EXIST WET WELL LID, EXPOSE LID AND SAWCUT ALONG TOP OF WALLS, SEE NOTE 1

DEMO EXIST PUMP STATION BUILDING, SEE 3B-IC, 3B-E AND 3B-H SHTS FOR BUILDING DEMOLTION

PROTECT EXIST ANTENNA POLE

REMOVE AND DISPOSE OF EXIST CABLE BOX

4"SSFM

8"SS

3/4"W

E

1342

SHEET NOTES:

1. COORDINATE ELEVATION OF SAWCUT WITH THICKNESS OF THE PROPOSED TOP SLAB TO MEET THE RIM FINISH GRADE SHOWN ON 3B-C5.

TREE REMOVAL TABLE

NO.	TYPE	DBH (IN.)
1	RED ALDER	12
2	RED ALDER	11
3	RED ALDER	9
4	RED ALDER	9
5	RED ALDER	6
6	NO DATA	NO DATA
7	RED ALDER	6
8	COTTONWOOD	8
9	COTTONWOOD	42
10	COTTONWOOD	38
11	COTTONWOOD	40

PLAN
SCALE: 1"=5'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-C3 66 of 184

OREGON PROFESSIONAL ENGINEER 98172 Nicholas S. Laferriz Date: 08/30/2024 RENEWS 12-31-26

OREGON REGISTERED LICENSED LANDSCAPE ARCHITECT Nicholas S. Laferriz Date: 08/30/2024 RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
SITE DEMOLITION PLAN

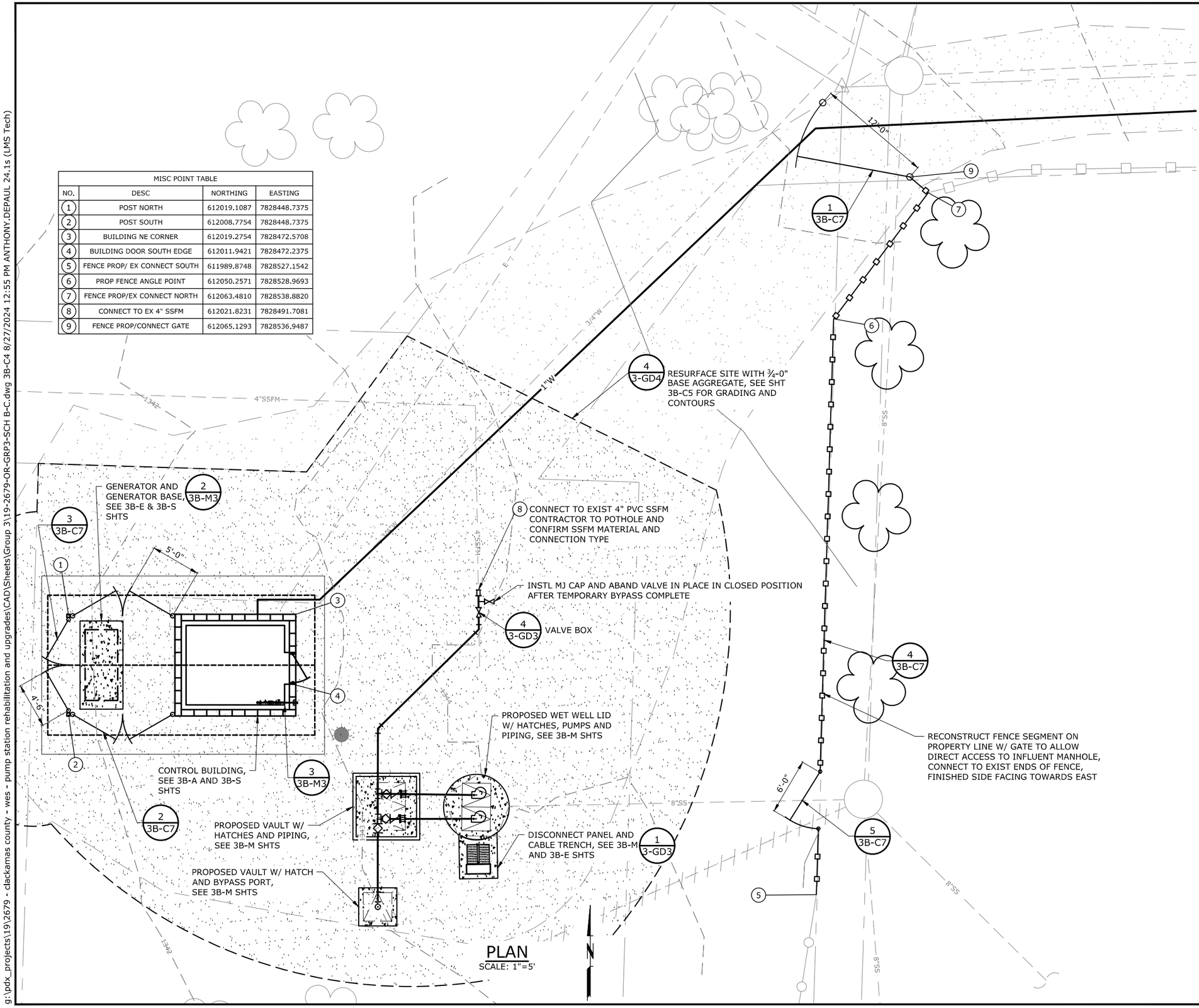
consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

MISC POINT TABLE			
NO.	DESC	NORTHING	EASTING
1	POST NORTH	612019.1087	7828448.7375
2	POST SOUTH	612008.7754	7828448.7375
3	BUILDING NE CORNER	612019.2754	7828472.5708
4	BUILDING DOOR SOUTH EDGE	612011.9421	7828472.2375
5	FENCE PROP/ EX CONNECT SOUTH	611989.8748	7828527.1542
6	PROP FENCE ANGLE POINT	612050.2571	7828528.9693
7	FENCE PROP/EX CONNECT NORTH	612063.4810	7828538.8820
8	CONNECT TO EX 4" SSFM	612021.8231	7828491.7081
9	FENCE PROP/CONNECT GATE	612065.1293	7828536.9487



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NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-C4 67 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 OREGON Nicholas S. Laferriere Date: 12/31/25

LICENSED PROFESSIONAL ENGINEER 98172 ILLINOIS Nicholas S. Laferriere Date: 12/31/25

RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
SITE PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

DATE: MAY 2025
19-2679
PROJECT:

SEE 3B-C6 FOR WATER SERVICE TRENCH SURFACING

PS BUILDING
FF ELEV = 1344.70'

VALVE VAULT
RIM ELEV = 1344.70'

WET WELL
RIM ELEV = 1344.70'

DISC PANEL
TOP OF SLAB ELEV = 1344.70'

BYPASS VAULT
RIM ELEV = 1344.70'

4"SSFM

8"SS

3/4"W

E-T

PWET

1342

1343

1344

PLAN
SCALE: 1"=5'

N

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-C5 68 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
98172
Nicholas S. Laferriere
Date:
RENEWS 12-31-26

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT
OREGON
Nicholas S. Laferriere
Date:

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
SURFACING AND GRADING PLAN

consor

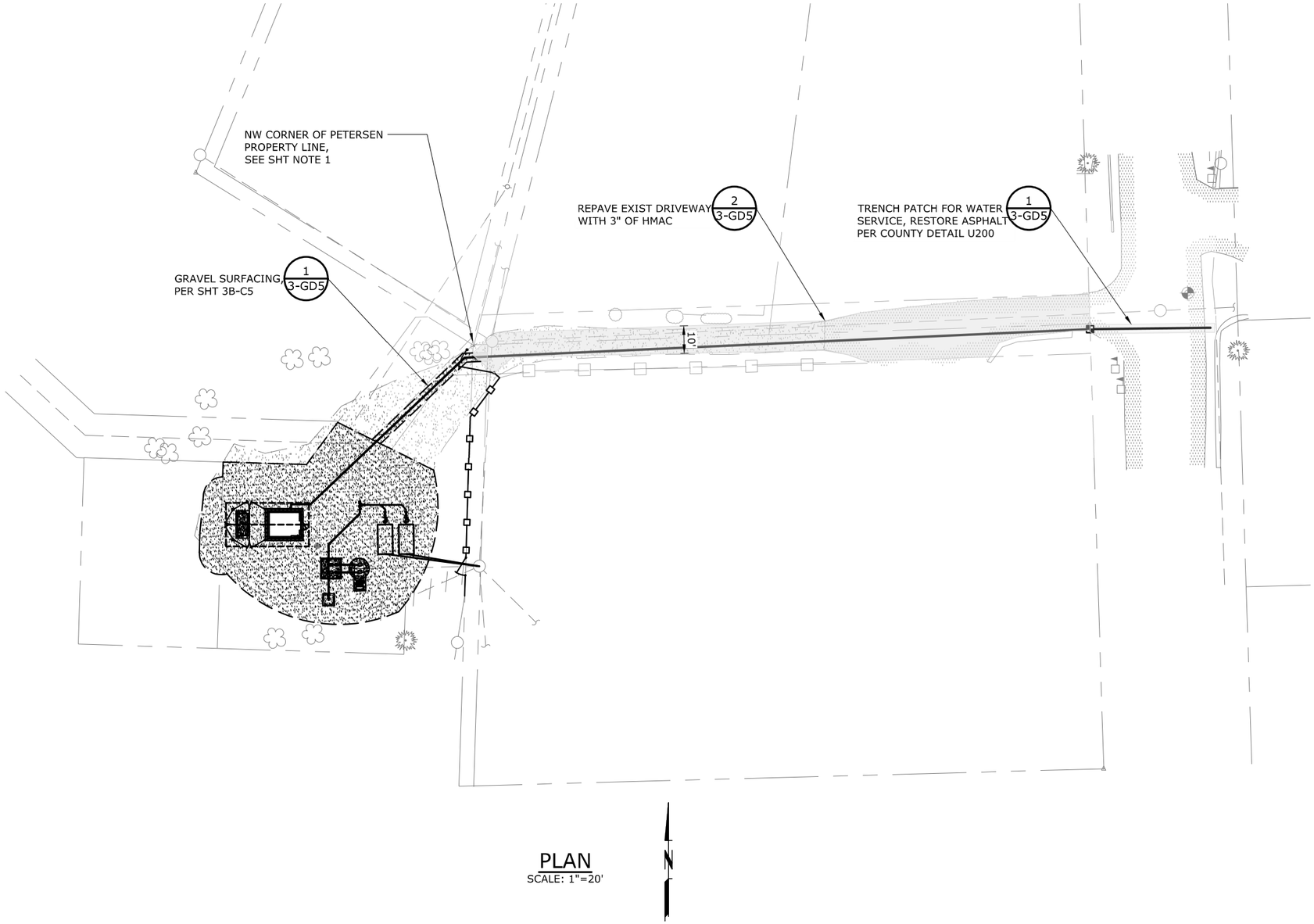
CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

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SHEET NOTES:

1. CONTRACTOR TO SURVEY AND MARK THE FOUR CORNERS OF THE PROPERTY DIRECTLY EAST OF THE PUMP STATION SITE.



PLAN
SCALE: 1"=20'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-C6 69 of 184

OREGON PROFESSIONAL ENGINEER 98172 Nicholas S. Laferriz Date: 12/31/26

OREGON PROFESSIONAL ENGINEER 98172 Nicholas S. Laferriz Date: RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

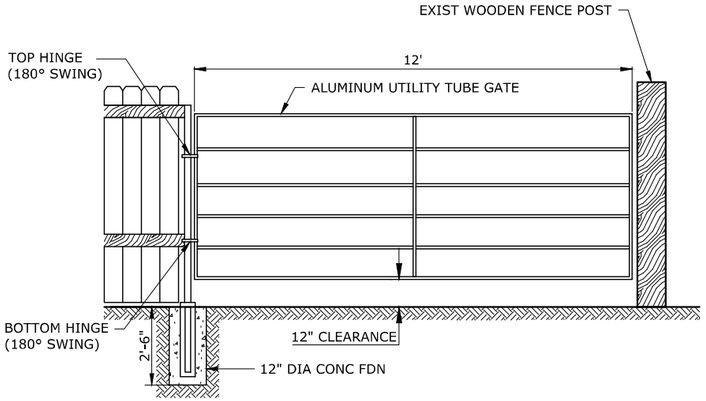
GOLF CLUB TER PUMP STATION
WATER SERVICE CONNECTION PLAN

consor

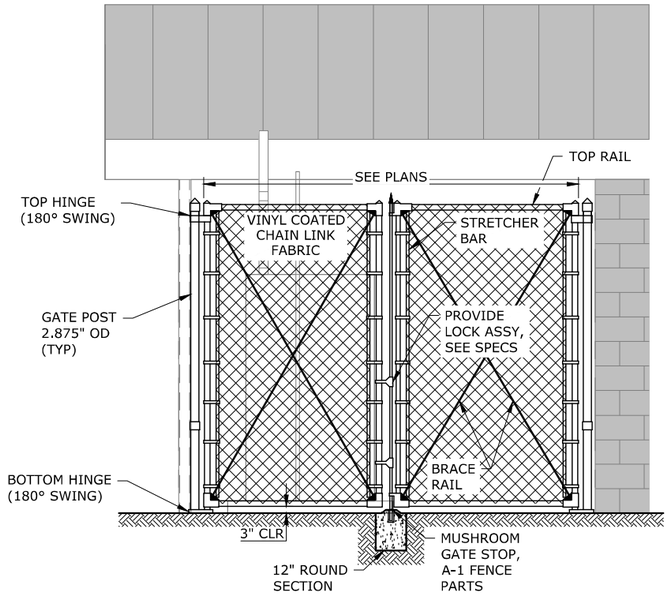
CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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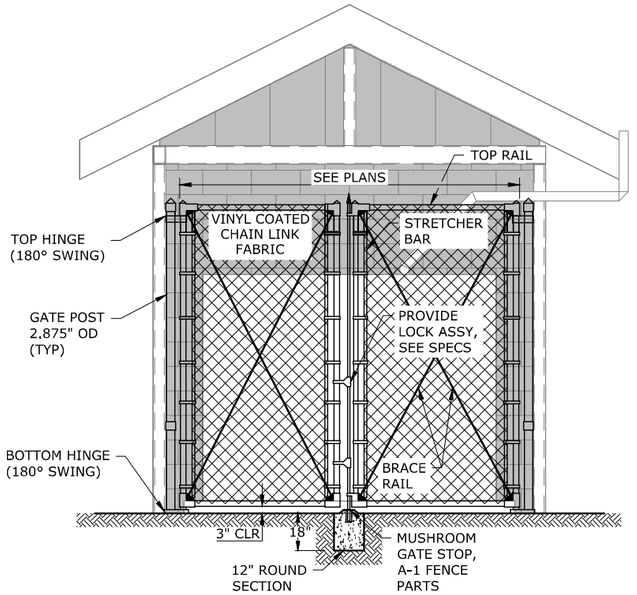
UTILITY GATE (1 / 3B-C4)
SCALE: NTS



NOTE:

1. PROVIDE LOCK ASSEMBLY AND GATE STOP FOR EACH GATE, SEE SPECIFICATIONS.

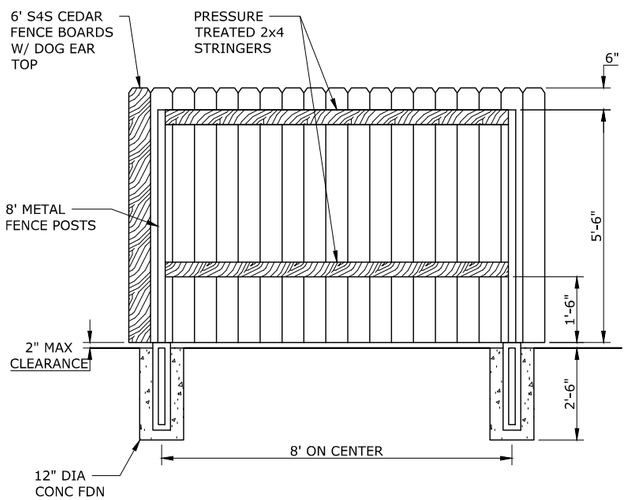
DOUBLE SWING GATE A (2 / 3B-C4)
SCALE: NTS



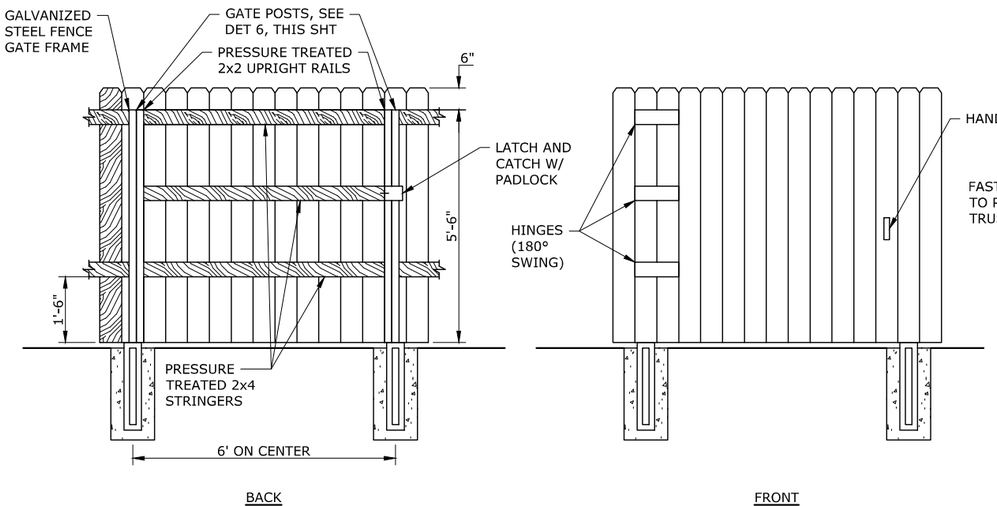
NOTE:

1. PROVIDE LOCK ASSEMBLY AND GATE STOP FOR EACH GATE, SEE SPECIFICATIONS.

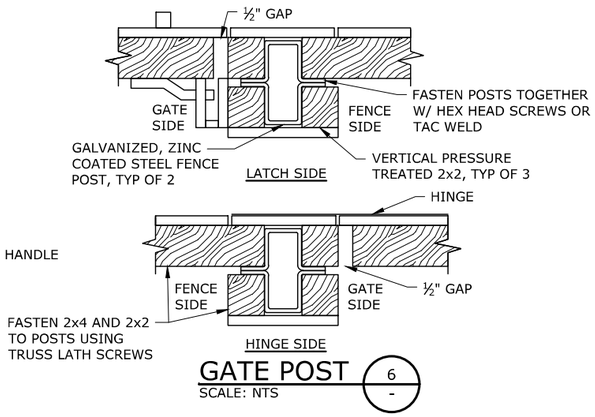
DOUBLE SWING GATE B (3 / 3B-C4)
SCALE: NTS



CEDAR FENCE (4 / 3B-C4)
SCALE: NTS



CEDAR GATE (5 / 3B-C4)
SCALE: NTS



GATE POST (6 / -)
SCALE: NTS

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
CIVIL DETAILS

SHEET 3B-C7
70 of 184

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

REGISTERED PROFESSIONAL ENGINEER 98172 OREGON Nicholas S. Lafrenz
RENEWS 12-31-26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

consor

DATE: MAY 2025
19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT:

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH B-C.dwg 3B-C7 8/27/2024 12:55 PM ANTHONY.DEPAUL 24.1s (LMS Tech)

PLANT_SCHEDULE				
SYMBOL	CODE	BOTANICAL / COMMON NAME	PLANTING SIZE	QTY
TREES				
	ALN RUB	ALNUS RUBRA / RED ALDER	1" CAL.	2
	THU ATR	THUJA PLICATA 'ATROVIRENS' / WESTERN RED CEDAR	6` HT.	2

NOTES:

1. SEE SHEET 3B-L2 FOR PLANTING DETAILS.

N

PLAN
SCALE: 1"=5'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-L1 71 of 184

REGISTERED LANDSCAPE ARCHITECT
OREGON
Kristofer Kurtz
2005.05.18
RENEWS 5-31-25

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

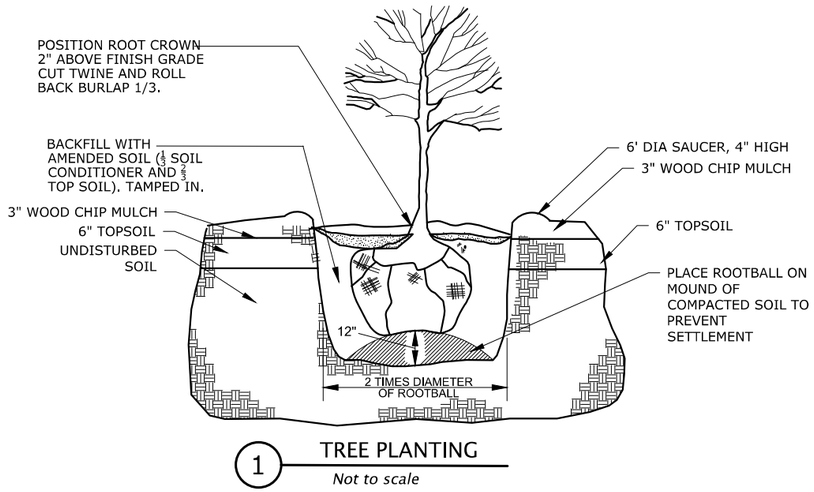
STREAM BUFFER LANDSCAPING PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH A-LU-LDSCP.dwg 3B-L1 8/27/2024 9:55 AM ANTHONY.DEPAUL 24.1s (LMS Tech)



1 TREE PLANTING

Not to scale

PLANTING METHODS:

1. SOIL PREPARATION: TILL THE SUB-GRADE IN THESE AREAS TO A DEPTH OF AT LEAST FOUR INCHES AND ADD AT LEAST 12 INCHES OF CLEAN COMPOST-AMENDED TOPSOIL. THE COMPOST-AMENDED TOPSOIL SHALL HAVE A GOOD GROWING MEDIUM WITH TEXTURE MATERIAL THAT PASSES THROUGH ONE-INCH AND 35% ORGANIC MATTER FERTILITY.

2. PLANTING TIME: CONTAINERIZED STOCK SHALL BE INSTALLED ONLY FROM MARCH 1 THROUGH MAY 15 AND OCTOBER 1 THROUGH NOVEMBER 15. PLANTINGS OUTSIDE THESE TIMES MAY REQUIRE ADDITIONAL MEASURES APPROVED BY THE ENGINEER TO ENSURE PLANTS SURVIVAL.

3. All PLANTS SHALL BE INSTALLED IN ACCORDANCE WITH AMERICAN NURSERYMAN STANDARDS. INSTALLED PLANTS SHALL TAGGED FOR DORMANT SEASON IDENTIFICATION AND SHALL REMAIN ON PLANT MATERIALS AFTER PLANTING FOR MONITORING PURPOSES.

4. IF NEEDED, INSTALL STAKES TO SUPPORT TREES DURING PLANT ESTABLISHMENT PERIOD.

5. EROSION CONTROL: GRADING, SOIL PREPARATION, AND SEEDING SHALL BE PERFORMED DURING OPTIMAL WEATHER CONDITIONS AND AT LOW FLOW LEVELS TO MINIMIZE SEDIMENT IMPACTS.

6. MULCHING: TREES, SHRUBS, AND GROUNDCOVER AREAS SHALL BE MULCHED A MINIMUM OF THREE INCHES IN DEPTH AND 18 INCHES IN DIAMETER, TO RETAIN MOISTURE AND DISCOURAGE WEED GROWTH AROUND NEWLY INSTALLED PLANT MATERIAL. APPROPRIATE MULCHES ARE MADE FROM COMPOSTED BARK OR LEAVES THAT HAVE NOT BEEN CHEMICALLY TREATED.

7. WEED CONTROL: THE REMOVAL OF NUISANCE AND INVASIVE WEEDS SHALL BE NECESSARY THROUGHOUT THE MAINTENANCE PERIOD, AND UNTIL A HEALTHY STAND OF DESIRABLE VEGETATION IS ESTABLISHED.

8. PLANT REPLACEMENT AND PRESERVATION: INSTALLED PLANTS THAT ARE UNHEALTHY OR DAMAGED SHALL BE REPLACED DURING THE MAINTENANCE PERIOD. PRIOR TO REPLACEMENT, THE CAUSE OF LOSS (WILDLIFE DAMAGE, POOR PLANT STOCK, ETC.) SHALL BE DOCUMENTED WITH A DESCRIPTION OF THE CORRECTIVE ACTIONS TAKEN.

PLANTS MAINTENANCE NOTES:

1. THE CONTRACTOR SHALL VERIFY TREES INSTALLATION LOCATION WITH THE OWNER.

2. THE OWNER SHALL BE RESPONSIBLE FOR WATERING TO KEEP PLANTS HEALTHY AND IN GOOD GROWING CONDITIONS.

3. THERE WILL BE NO PLANT ESTABLISHMENT PERIOD. THE OWNER SHALL BE RESPONSIBLE FOR ALL PLANTS MAINTENANCE SUCH AS WEEDING AND REPLACEMENT OF ANY DAMAGED OR DEAD PLANTS.

NO.	DATE	REVISION	BY

DESIGNED: FE
DRAWN: FE
CHECKED: DAM
APPROVED: XXX

SHEET 3B-L2 72 of 184

REGISTERED LANDSCAPE ARCHITECT
748
Kristy Ingersoll
by Nicholas 55
OREGON
2025.05.30
RENEWS 5-31-25

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

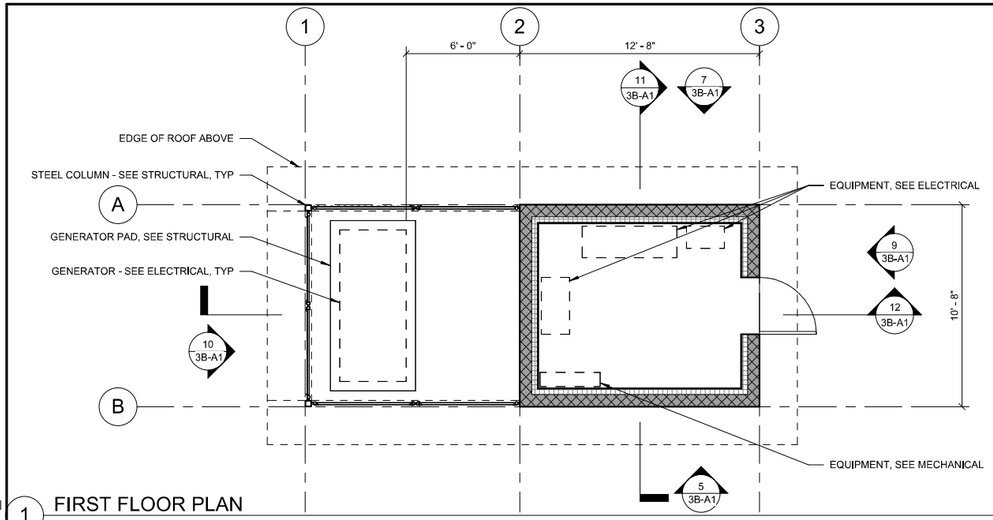
STREAM BUFFER LANDSCAPING DETAILS

consor

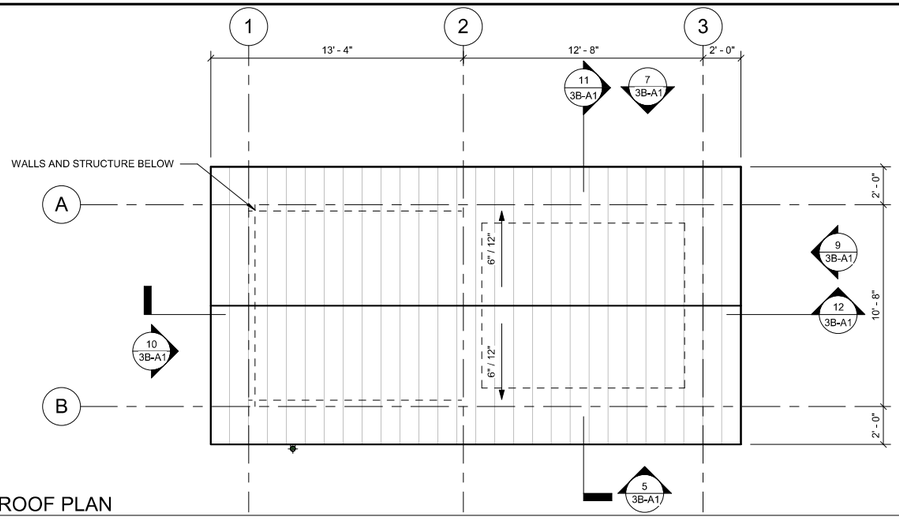
CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH A-LU-LDSCP.dwg 3B-L2 8/27/2024 9:55 AM ANTHONY.DEPAUL 24.1s (LMS Tech)



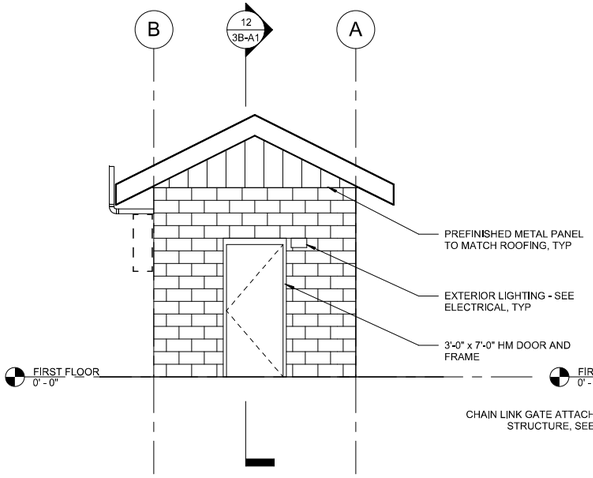
1 FIRST FLOOR PLAN
SCALE: 1/4" = 1'-0"



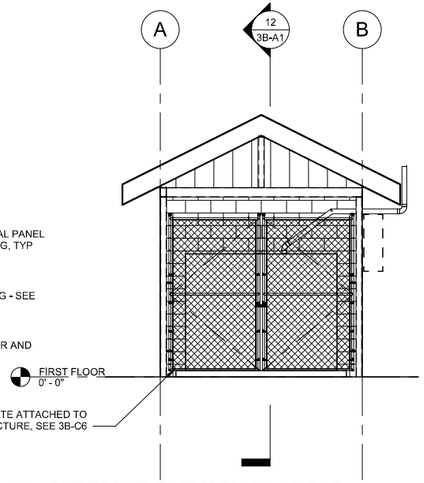
3 ROOF PLAN
SCALE: 1/4" = 1'-0"

5 EXTERIOR ELEVATION - SOUTH
SCALE: 1/4" = 1'-0"

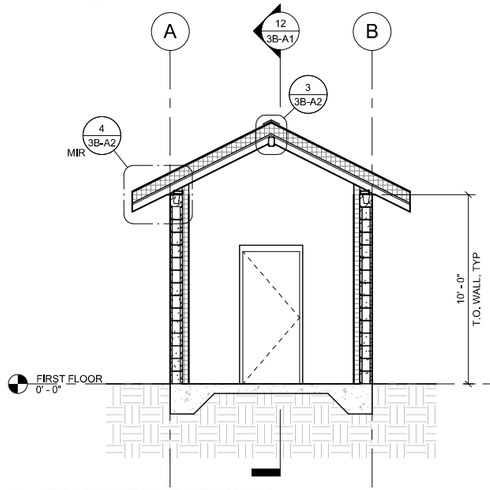
7 EXTERIOR ELEVATION - NORTH
SCALE: 1/4" = 1'-0"



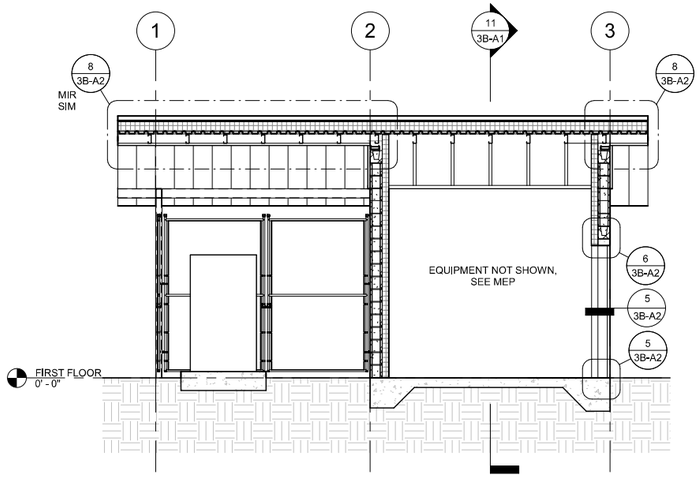
9 EXTERIOR ELEVATION - EAST
SCALE: 1/4" = 1'-0"



10 EXTERIOR ELEVATION - WEST
SCALE: 1/4" = 1'-0"



11 TRANSVERSE SECTION
SCALE: 1/4" = 1'-0"



12 LONGITUDINAL SECTION
SCALE: 1/4" = 1'-0"

C:\Users\human\Strongwork Dropbox_ACTIVE PROJECTS_21001_WES Pump Stations Upgrade\WES Group III\Design Information\21001_WES PS_R23.rvt

mwa architects

NO.	DATE	REVISION	BY
1			

DESIGNED: MD
DRAWN: DH
CHECKED: MD
APPROVED: AA

SHEET 3B-A1
73 of 184

REGISTERED ARCHITECT
ALAN P. ARMSTRONG
PORTLAND, OREGON
STATE OF OREGON

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

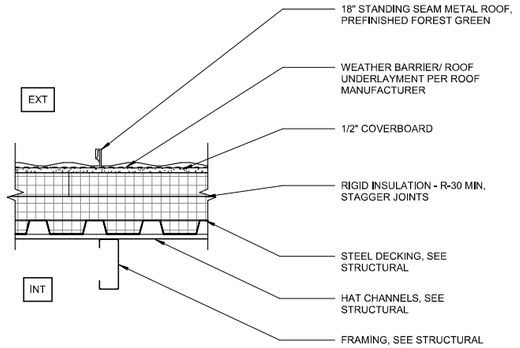
PUMP STATION REHABILITION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
FLOOR AND ROOF PLANS, ELEVATIONS, AND SECTIONS

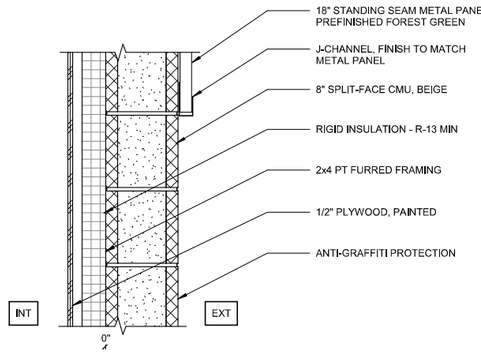
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CLACKAMAS WATER ENVIRONMENT SERVICES

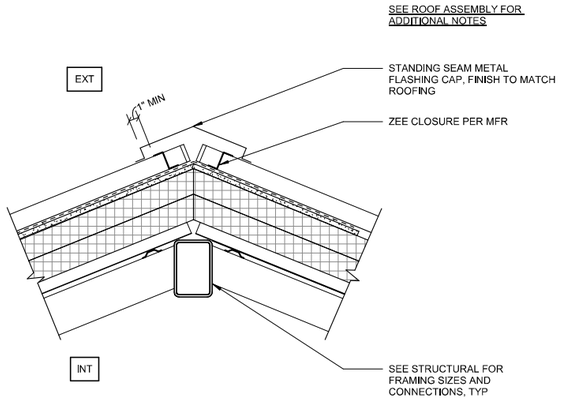
PROJECT: 19-2679
DATE: May 2025



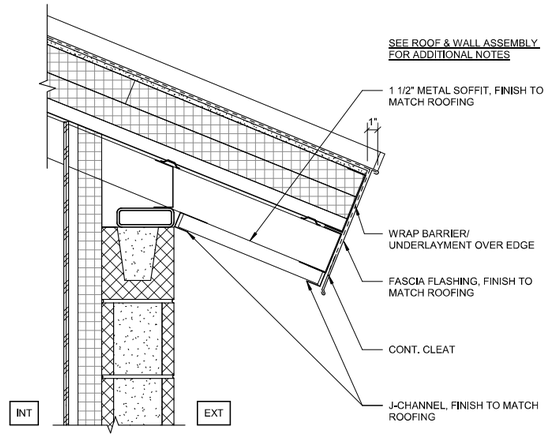
1 TYP ROOF ASSEMBLY
SCALE: 1 1/2" = 1'-0"



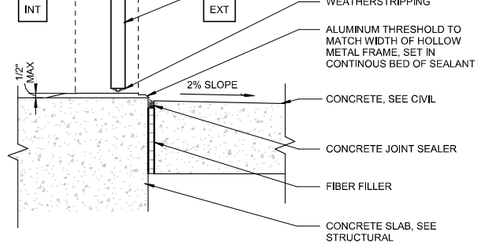
2 TYP WALL ASSEMBLY
SCALE: 1 1/2" = 1'-0"



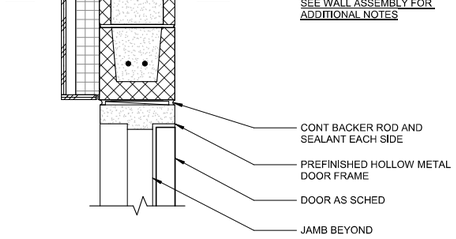
3 ROOF RIDGE
SCALE: 1 1/2" = 1'-0"



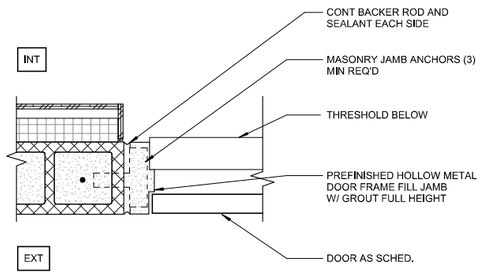
4 ROOF EAVE
SCALE: 1 1/2" = 1'-0"



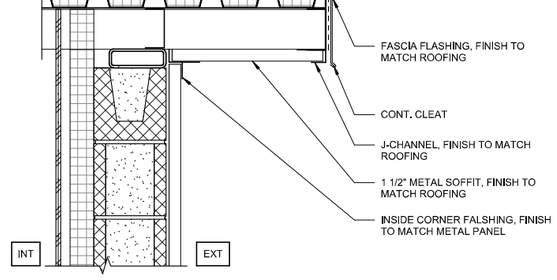
5 EXT. DOOR THRESHOLD
SCALE: 1 1/2" = 1'-0"



6 EXT. DOOR HEAD
SCALE: 1 1/2" = 1'-0"



7 EXT. DOOR JAMB
SCALE: 1 1/2" = 1'-0"



8 RAKE EDGE
SCALE: 1 1/2" = 1'-0"

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mwa architects

NO.	DATE	REVISION	BY

DESIGNED: MD
DRAWN: DH
CHECKED: MD
APPROVED: AA

SHEET 3B-A2
74 of 184

REGISTERED ARCHITECT ALAN P. ARMSTRONG PORTLAND, OREGON STATE OF OREGON

SCALE VERT: AS SHOWN HORIZ:AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

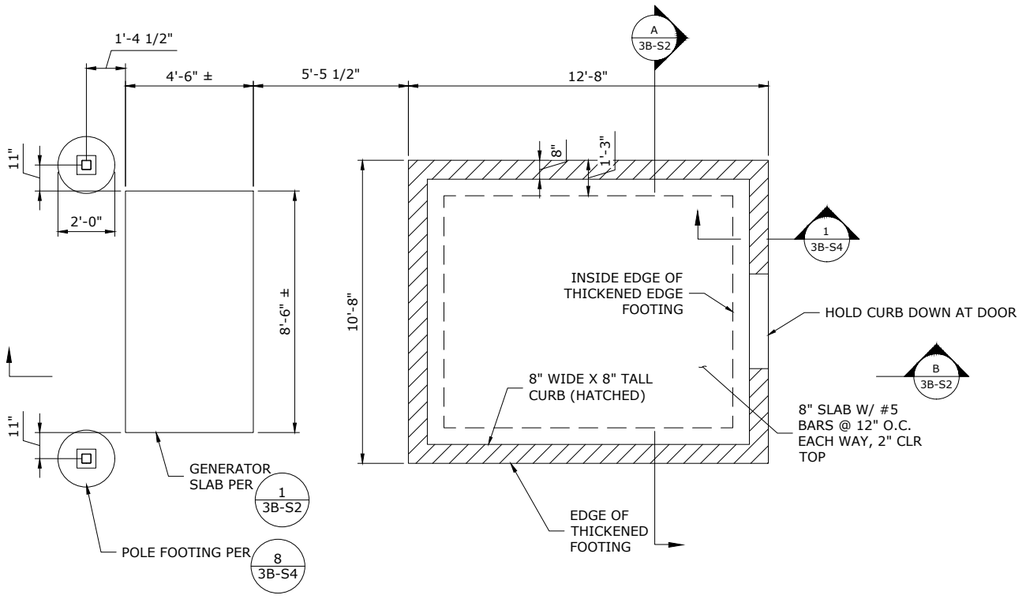
GOLF CLUB TER PUMP STATION
ARCHITECTURAL ASSEMBLIES AND DETAILS

consor

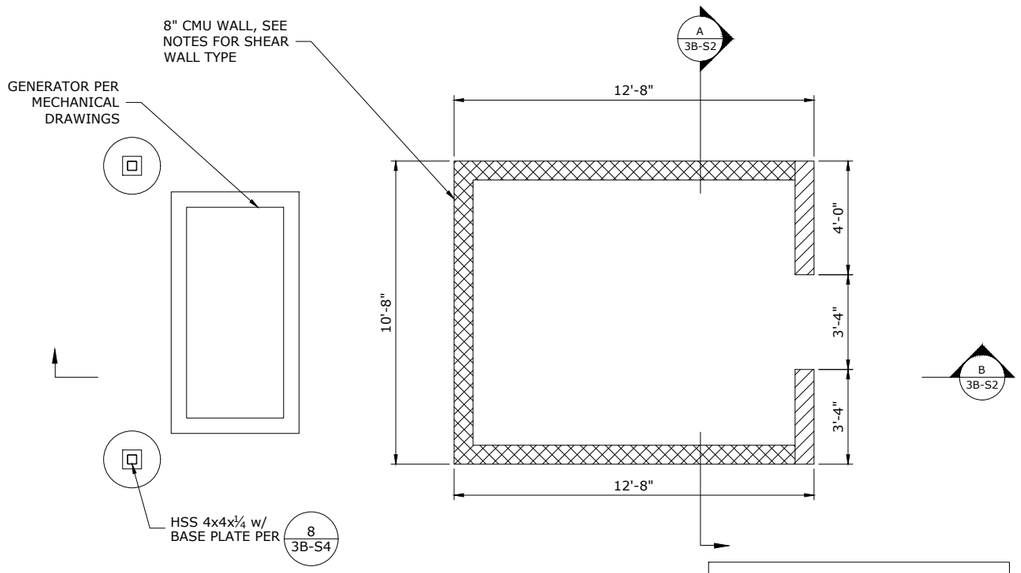
PROJECT: 19-2679 DATE: May 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Group 3 Final Drawings R2 1901-0206.dwg 3B-S1 5/15/2025 7:23 AM SAMRICHMANN 24.2s (LMS Tech)

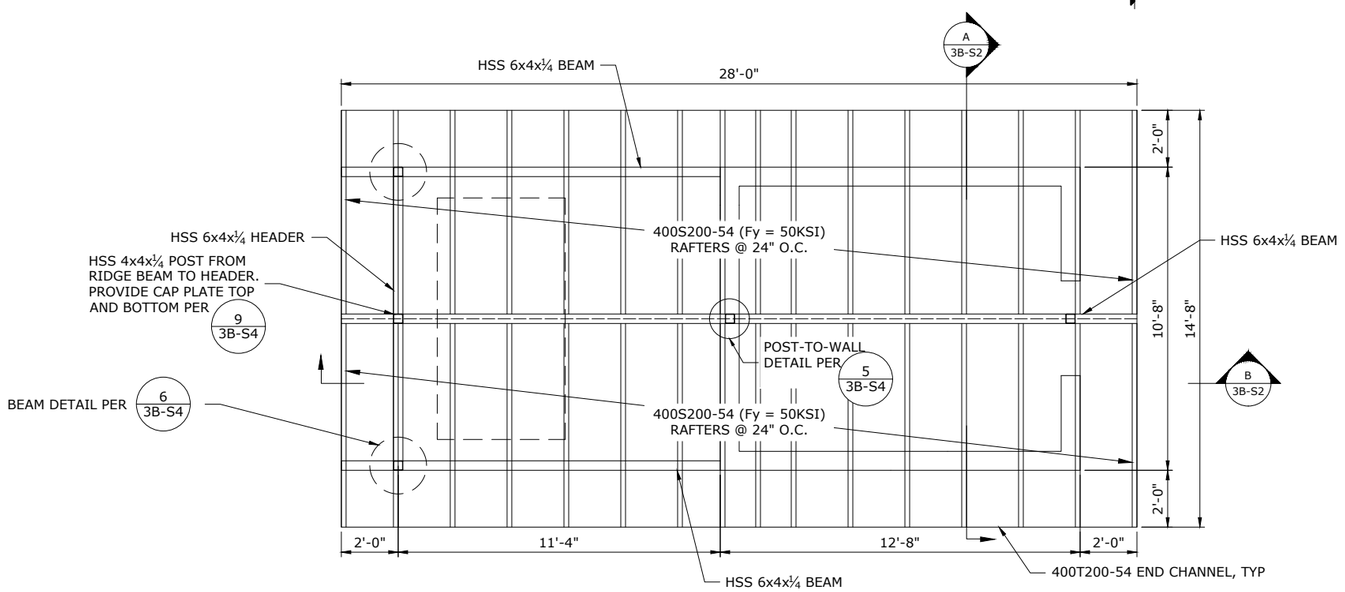


FOUNDATION PLAN 1 —
3/8" = 1'-0"



FLOOR PLAN 2 —
3/8" = 1'-0"

CMU WALL TYPES:
- WALL TYPE (A) PER 1 3B-S3
- WALL TYPE (B) PER 1 3B-S3



ROOF PLAN 3 —
3/8" = 1'-0"

NO.	DATE	REVISION	BY
		DESIGNED: SDR	
		DRAWN: SDR	
		CHECKED: EDA	
		APPROVED: TGM	

SHEET 3B-S1
75 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2021 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
FOUNDATION, FLOOR, AND ROOF PLANS

consor

DATE: MAY 2025

PROJECT: 19-2679

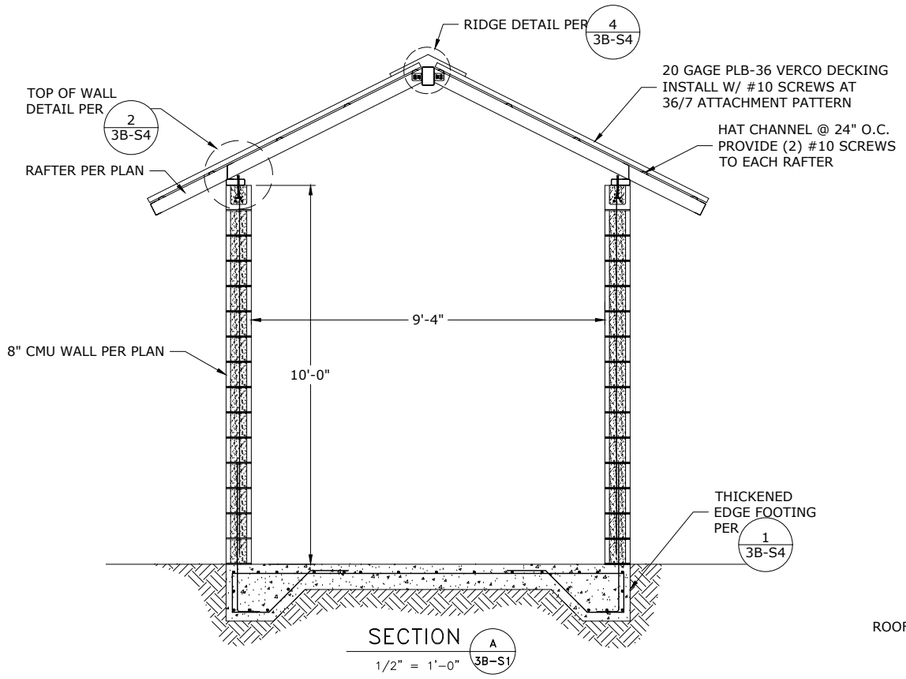
CLACKAMAS WATER ENVIRONMENT SERVICES

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

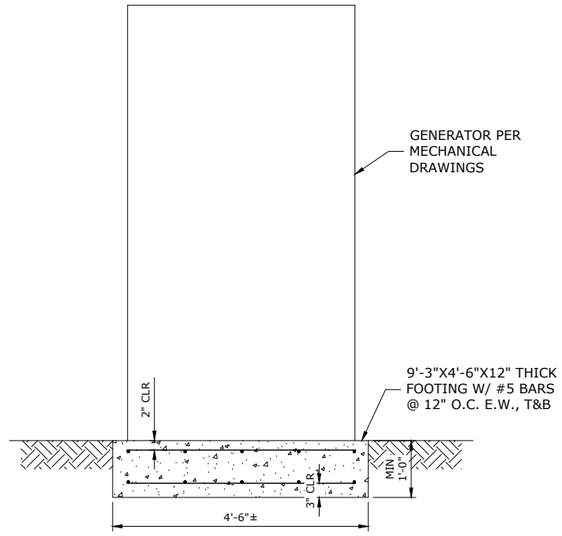
PSE Project #: 1901-0206

Date: 05/15/2025

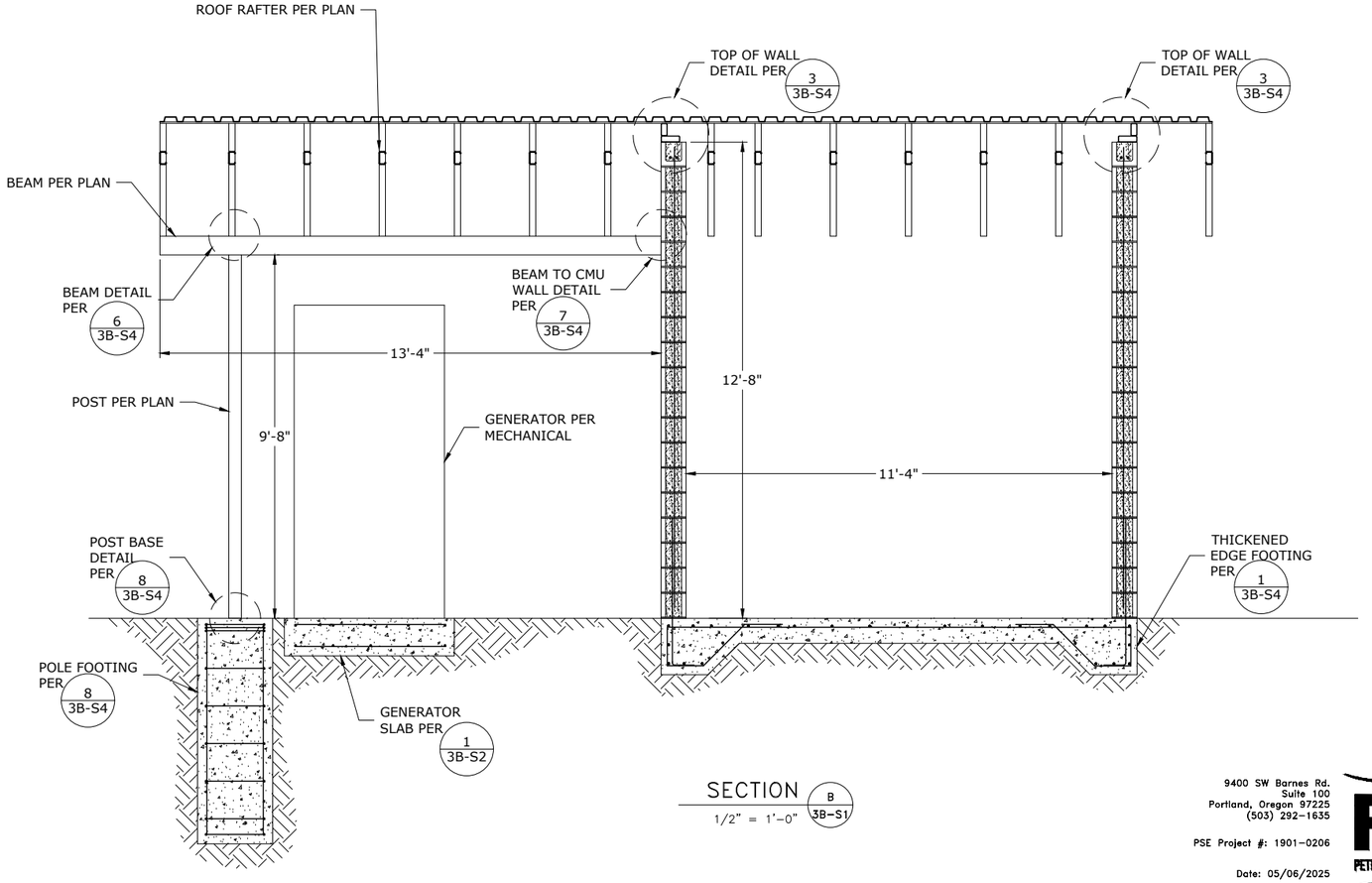
PSE PETERSON STRUCTURAL ENGINEERS



SECTION A 3B-S1
1/2" = 1'-0"



GENERATOR FOOTING 1 3B-S1
3/4" = 1'-0"



SECTION B 3B-S1
1/2" = 1'-0"

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PETERSON STRUCTURAL ENGINEERS

NO.	DATE	REVISION	BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3B-S2
76 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE ETHAN DAVID ALTON OREGON NOV. 9, 2021

EXPIRES 12/31/25

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE 0 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
BUILDING AND GENERATOR
FOOTING AND SECTIONS

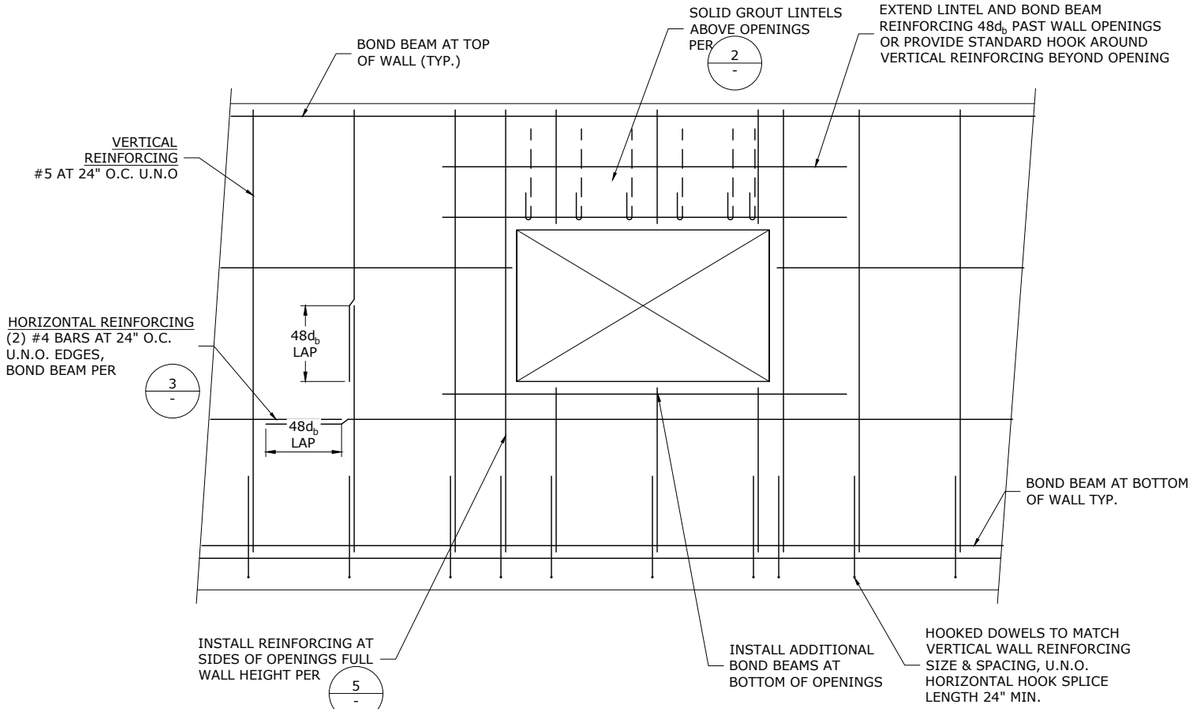
consor

DATE: MAY 2025

PROJECT: 19-2679

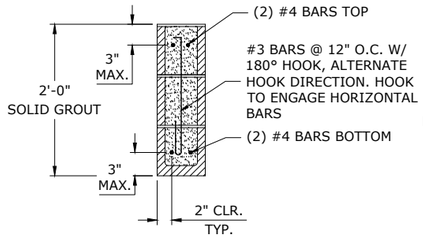
CLACKAMAS WATER ENVIRONMENT SERVICES

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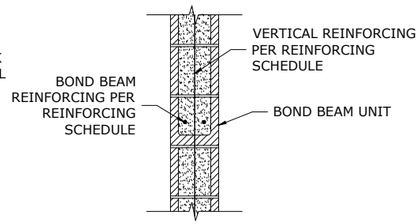


TYPICAL CMU WALL SECTION 1/3B-S1
1" = 1'-0"

CMU NOTES:
1. ALL CELLS SHALL BE SOLID GROUTED
2. HOOK ALL REINFORCING THAT CANNOT BE EXTENDED.
3. TYPICAL REINFORCING IS SHOWN. REFER TO DETAILS FOR SPECIFIC OR ADDITIONAL REINFORCING
4. LAP ALL REINFORCING A MINIMUM OF 48 BAR DIAMETERS
5. USE LINTEL BLOCK AT LINTELS & 48 BAR DIAMETERS PAST EACH SIDE OF LINTELS; BOND BEAM BLOCKS ARE NOT PERMITTED.
6. BOND BEAMS AT TOP OF WALL SHALL BE CONTINUOUS WITH STANDARD REINFORCING.

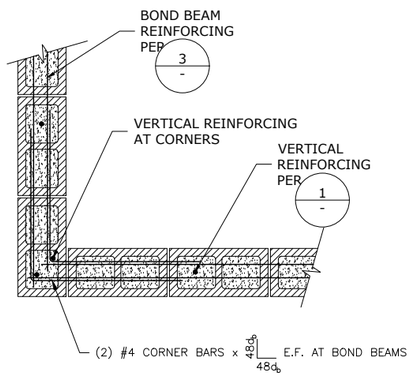


CMU LINTEL DETAIL 2/-
1" = 1'-0"

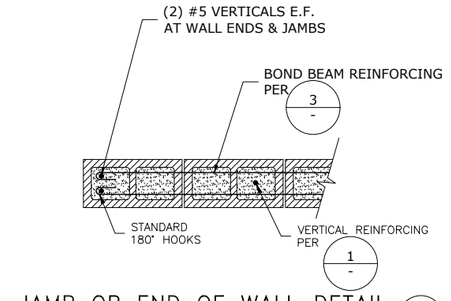


BOND BEAM DETAIL 3/-
1" = 1'-0"

REINFORCING SCHEUDLE		
TYPE	HORIZ. REINFORCING	VERT. REINFORCING
Ⓐ	(2) #4 @ 24" O.C.	#5 @ 24" O.C.
Ⓑ	(2) #4 @ 16" O.C.	#5 @ 16" O.C.

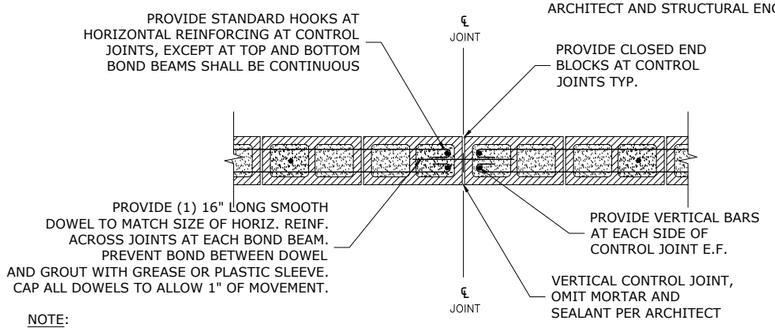


BOND BEAM DETAIL 4/-
1" = 1'-0"



JAMB OR END OF WALL DETAIL 5/-
1" = 1'-0"

NOTE:
PROVIDE CONTROL JOINTS AT INTERVALS NOT TO EXCEED 40'-0" OR (2) TIMES THE WALL HEIGHT, UNLESS SPECIFICALLY NOTED OTHERWISE. CONTRACTOR SHALL COORDINATE LOCATION OF JOINT WITH ARCHITECT AND STRUCTURAL ENGINEER



NOTE:
PROVIDE VERTICAL CONTROL JOINTS WHERE SHOWN ON AT INTERVALS NOT TO EXCEED 25'-0", UNLESS SPECIFICALLY NOTED OTHERWISE. CONTRACTOR SHALL COORDINATE LOCATION OF JOINT WITH ARCHITECT AND STRUCTURAL ENGINEER

CMU CONTROL JOINT 6/-
1" = 1'-0"

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PSE PETERSON STRUCTURAL ENGINEERS

NO.	DATE	REVISION	BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3B-S3 77 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2021 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 to 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
CMU STRUCTURAL DETAILS

consor

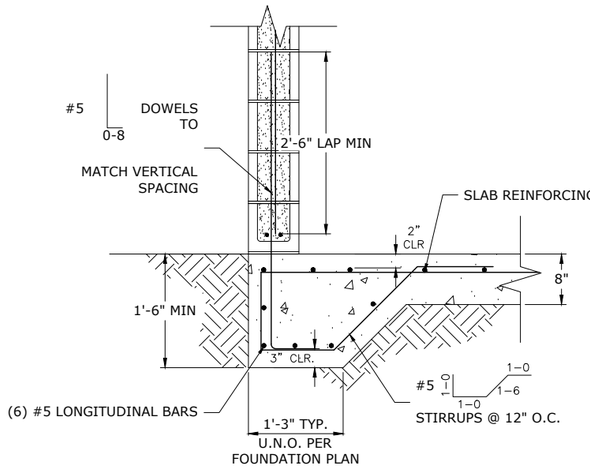
DATE: MAY 2025

PROJECT: 19-2679

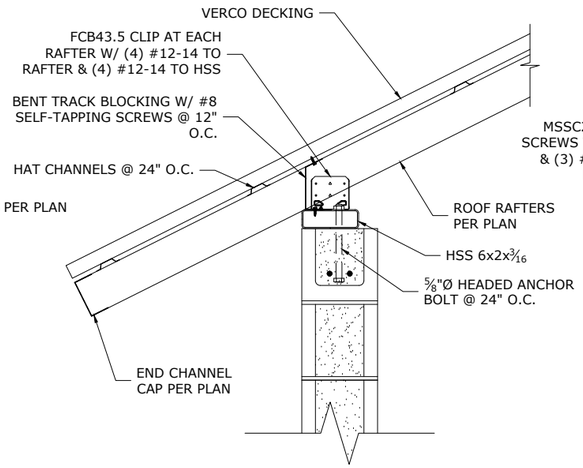
CLACKAMAS WATER ENVIRONMENT SERVICES

J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Group 3 Final Drawings R2 1901-0206.dwg 3B-S3 5/6/2025 2:11 PM SAMRICHMANN 24.2s (LMS Tech)

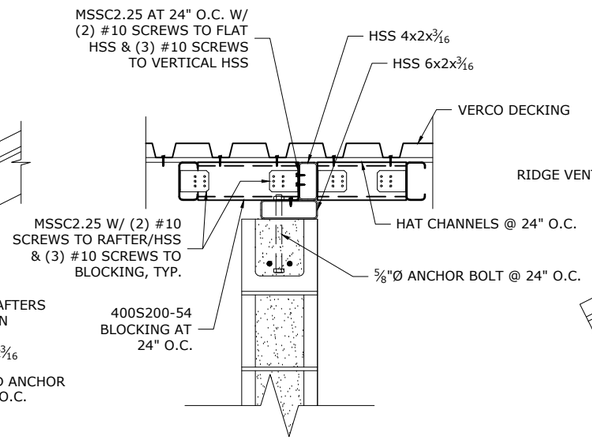
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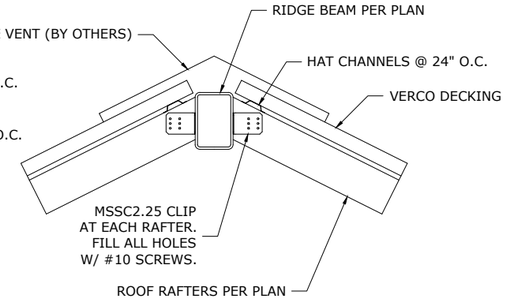
THICKENED EDGE DETAIL 1 / 3B-S1
1" = 1'-0"



TOP OF WALL DETAIL 2 / 3B-S2
1-1/2" = 1'-0"



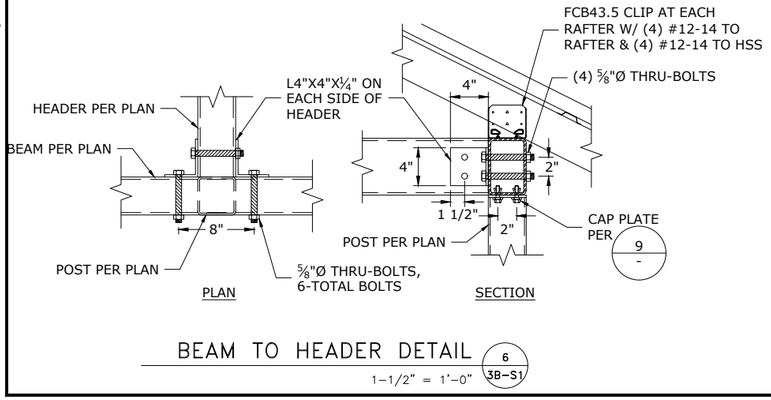
TOP OF WALL DETAIL 3 / 3B-S2
1-1/2" = 1'-0"



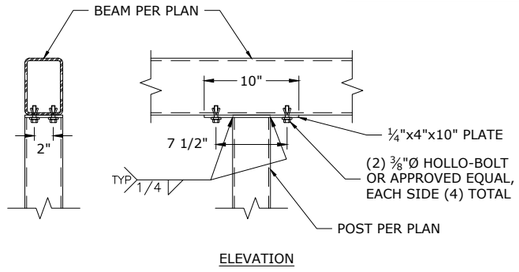
RIDGE DETAIL 4 / 3B-S1
1-1/2" = 1'-0"

RIDGE BEAM TO CMU DETAIL 5 / 3B-S1
1-1/2" = 1'-0"

BEAM TO CMU DETAIL 7 / 3B-S1
1-1/2" = 1'-0"



BEAM TO HEADER DETAIL 6 / 3B-S1
1-1/2" = 1'-0"



BEAM CAP PLATE DETAIL 9 / 3B-S1
1-1/2" = 1'-0"

POLE FOOTING 8 / 3B-S1
1" = 1'-0"

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PSE PETERSON STRUCTURAL ENGINEERS

NO.	DATE	REVISION	BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3B-S4
78 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2021 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
GENERAL STRUCTURAL DETAILS

consor

DATE: MAY 2025

PROJECT: 19-2679

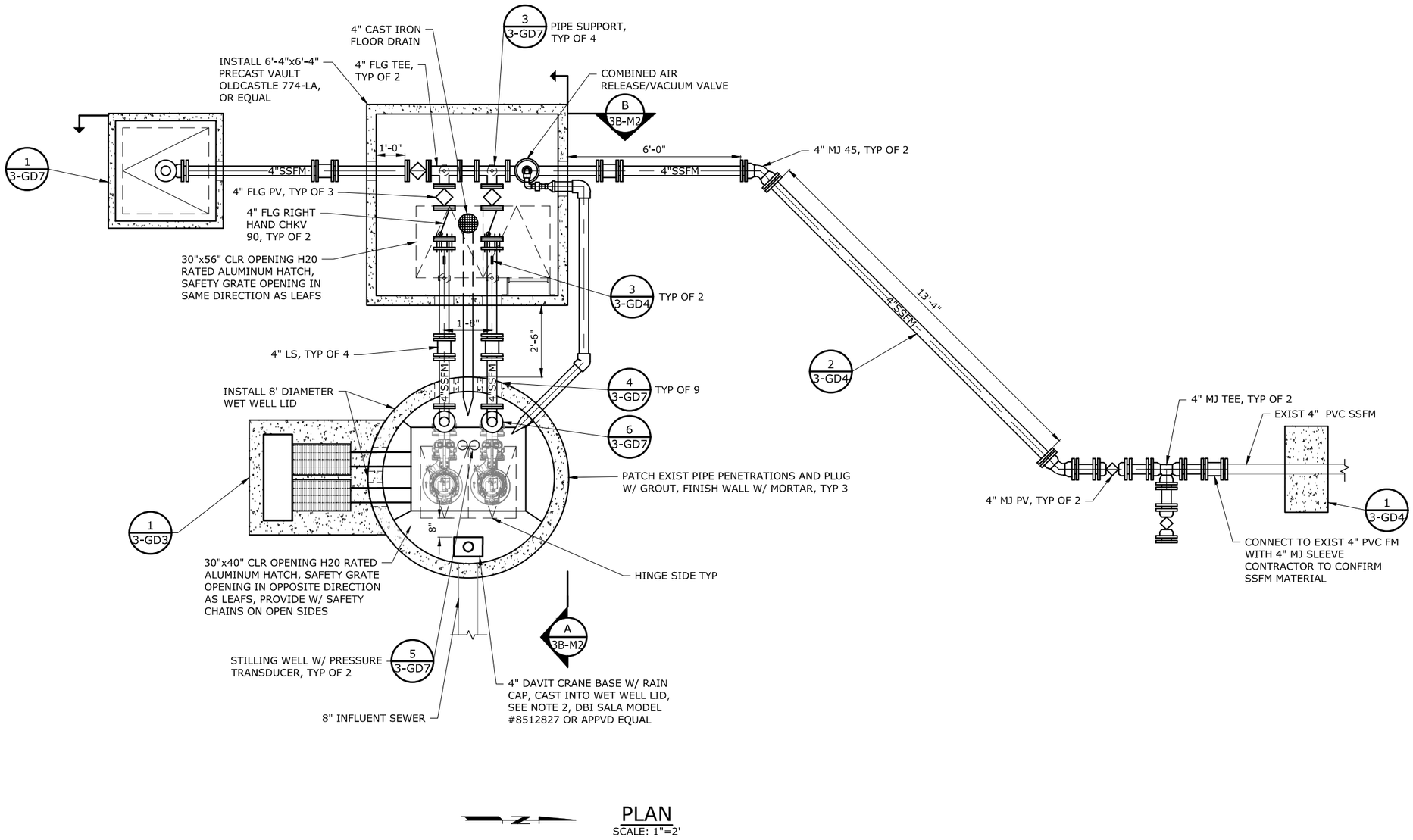
CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH B-M.dwg 3B-M1 4/28/2025 3:45 PM NICK.MCFADDIN 24.1s (LMS Tech)

SHEET NOTE:

1. ALL PIPE TO BE MECHANICALLY RESTRAINED.

2. DAVIT CRANE LOCATION IS APPROXIMATE, CONTRACTOR TO COORDINATE WET WELL LID REINFORCEMENT TO PROVIDE ADEQUATE SUPPORT FOR DAVIT CRANE.



PLAN
SCALE: 1"=2'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-M1 79 of 184

OREGON PROFESSIONAL ENGINEER 98172 Nicholas A. Laferriz Date: 12/31/2026
OREGON PROFESSIONAL ENGINEER 98172 Nicholas A. Laferriz Date: RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

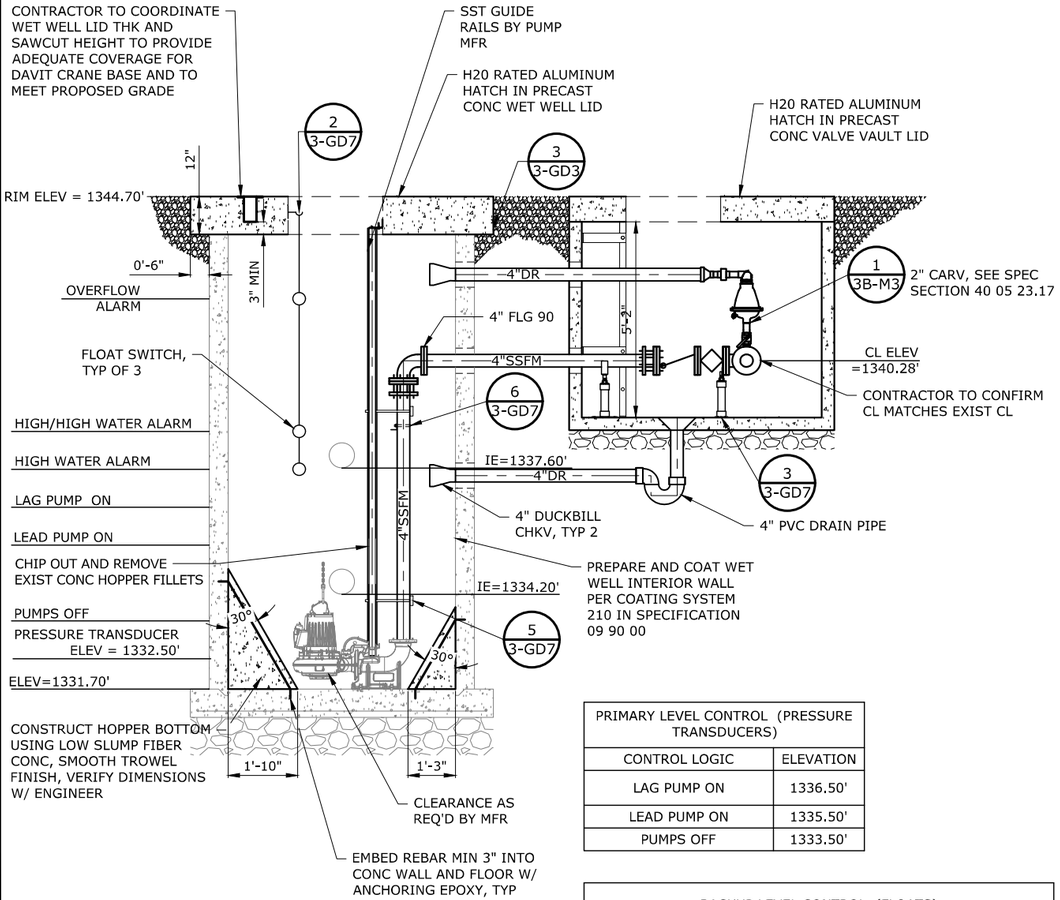
GOLF CLUB TER PUMP STATION
WET WELL AND VAULT PLAN

consor

DATE: MAY 2025

PROJECT: 19-2679

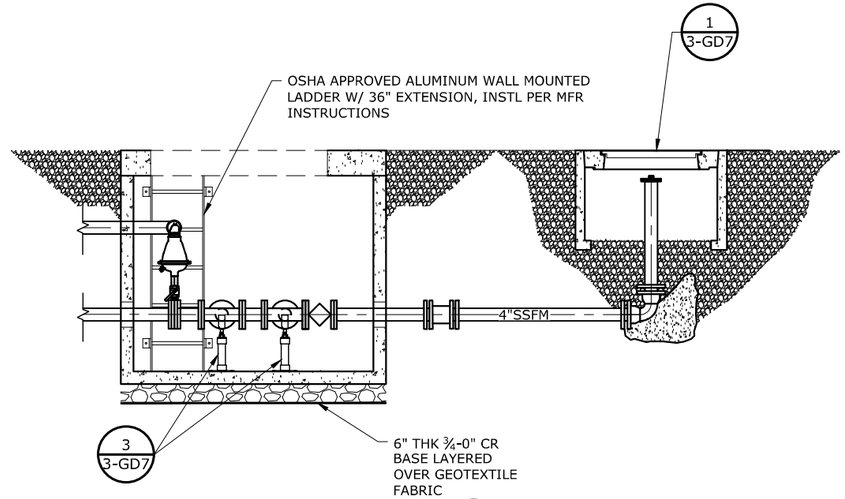
CLACKAMAS WATER ENVIRONMENT SERVICES



PRIMARY LEVEL CONTROL (PRESSURE TRANSDUCERS)	
CONTROL LOGIC	ELEVATION
LAG PUMP ON	1336.50'
LEAD PUMP ON	1335.50'
PUMPS OFF	1333.50'

BACKUP LEVEL CONTROL (FLOATS)		
CONTROL LOGIC	PUMP HARDWIRED TO	ELEVATION
HIGH WATER ALARM	PUMP 1	1337.50'
HIGH/HIGH WATER ALARM	PUMP 2	1338.50'
OVERFLOW ALARM	NONE	1342.00'

SECTION
SCALE: 1/2"=1'-0"
A 3B-M1



SECTION
SCALE: 1/2"=1'-0"
B 3B-M1

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabiltation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH B-M.dwg 3B-M2 4/28/2025 3:45 PM NICK.MCFADDIN 24.1s (LMS Tech)

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-M2
80 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas S. Laferriz
OREGON 1-1-2025 RENEWS
RENEWS 12-31-26

SCALE | VERT: AS SHOWN | HORIZ: AS SHOWN
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

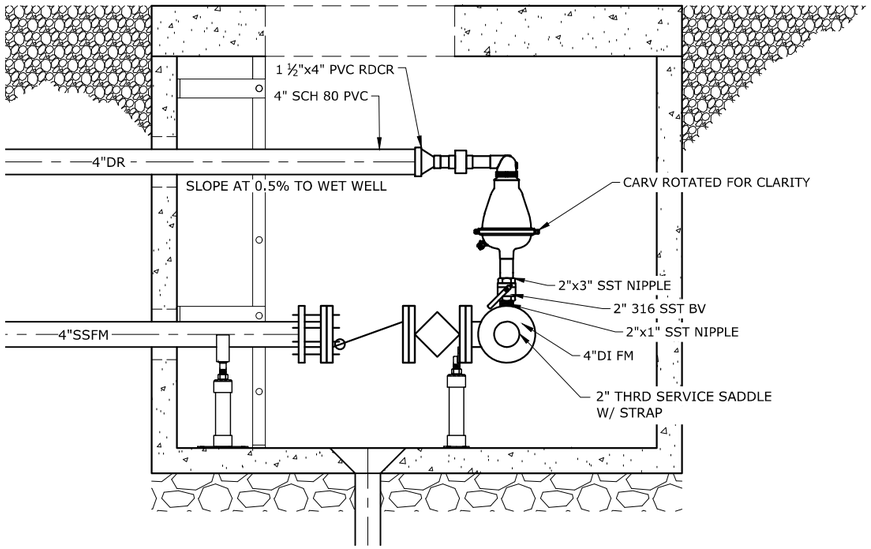
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
WET WELL AND VAULT SECTIONS

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 | DATE: MAY 2025

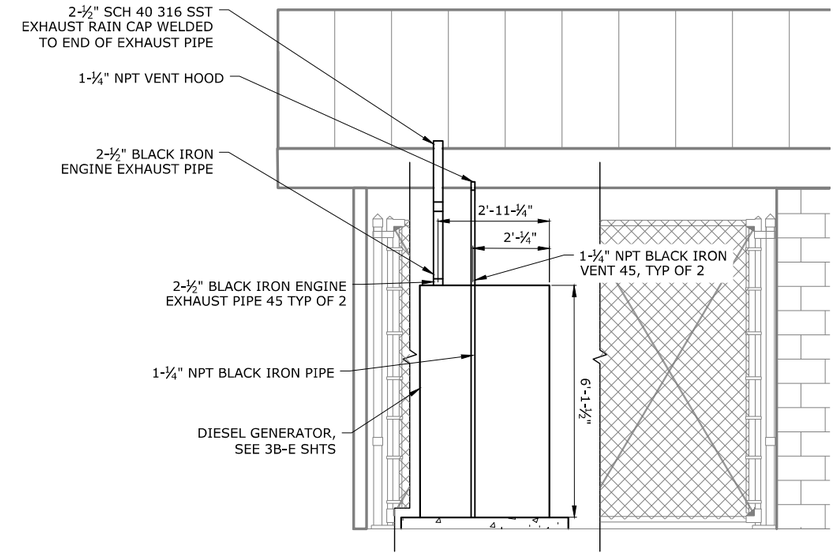


NOTE:

1. SEE SPEC SECTION 40 05 23.72 FOR CARV SPECIFICATIONS.

CARV DETAIL
SCALE: NTS

1 / 3B-M2

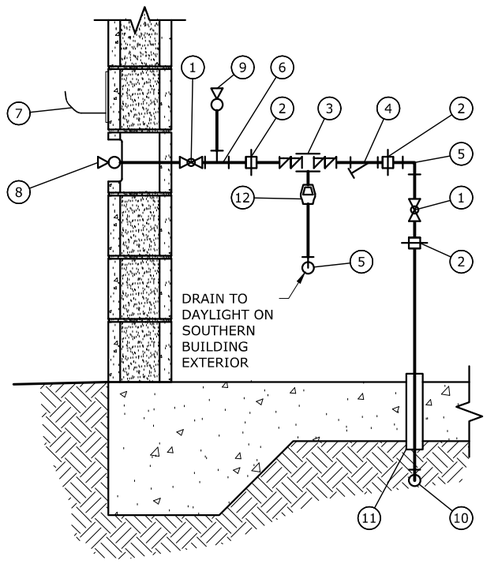


NOTE:

1. MINIMUM GENERATOR EXHAUST PIPE SIZE IS 2.5" ID, COORDINATE EXHAUST AND VENT PIPE SIZE WITH GENERATOR MANUFACTURER

GENERATOR EXHAUST AND BASE TANK VENT PIPING DETAIL
SCALE: NTS

2 / 3B-C4



KEY NOTES

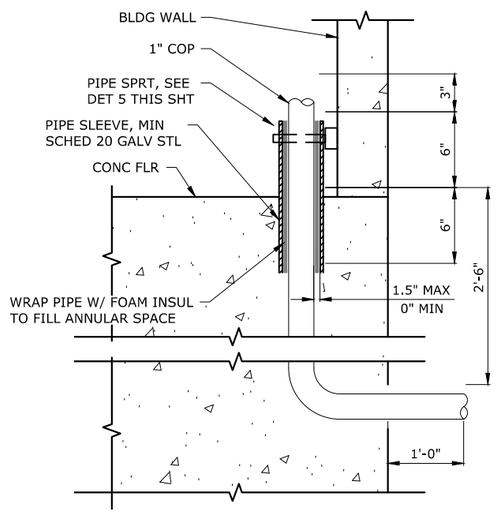
1. 1" BRONZE BV, TYP OF 2
2. 1" COP UNION, TYP OF 3
3. RPBA
4. 1" BRONZE WYE STRAINER
5. 1" COP 90 BEND, TYP OF 3
6. 1" COP TEE
7. HOSE HANGER, LOCATE PER OWNER
8. 1" NON-FREEZE HOSE BIBB IN LOCKABLE SST BOX RECESSED INTO BUILDING WALL
9. 1" BRONZE HOSE BIBB
10. 1" SUPPLY LINE, SEE SHT 3B-C4
11. PIPE SLEEVE, SEE DETAIL 4 THIS SHEET
12. AIR GAP

NOTE:

1. DETAIL DRAWN FACING SOUTH WALL FOR CLARITY.

PLUMBING DETAIL
SCALE: NTS

3 / 3B-C4

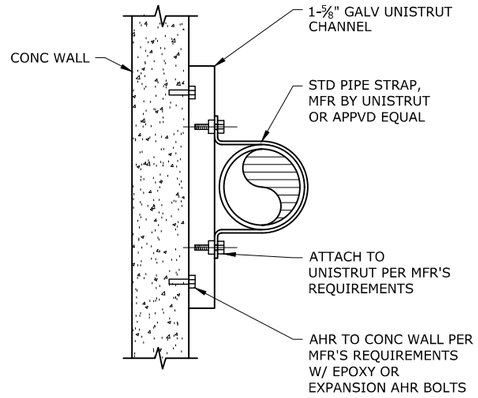


NOTE:

1. WRAP COPPER PIPE W/ PVC TAPE.

FLOOR PENETRATION SLEEVE DETAIL
SCALE: NTS

4 / -



NOTES:

1. ORIENT UNISTRUT CHANNEL VERTICALLY OR HORIZONTALLY DEPENDING ON APPLICATION.

2. SUPPORT PIPE HORIZONTALLY AT NO MORE THAN 6 FEET AND VERTICALLY AT NO MORE THAN 10 FEET.

PIPE SUPPORT DETAIL
SCALE: NTS

5 / -

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3B-M3 81 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98172 — Nicholas S. Lafrenz — Date: 12/31/26

RENEWS 12-31-26

SCALE | VERT: AS SHOWN | HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
MECHANICAL DETAILS

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabiltation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH B-M.dwg 3B-M3 4/28/2025 3:45 PM NICK.MCFADDIN 24.1s (LMS Tech)

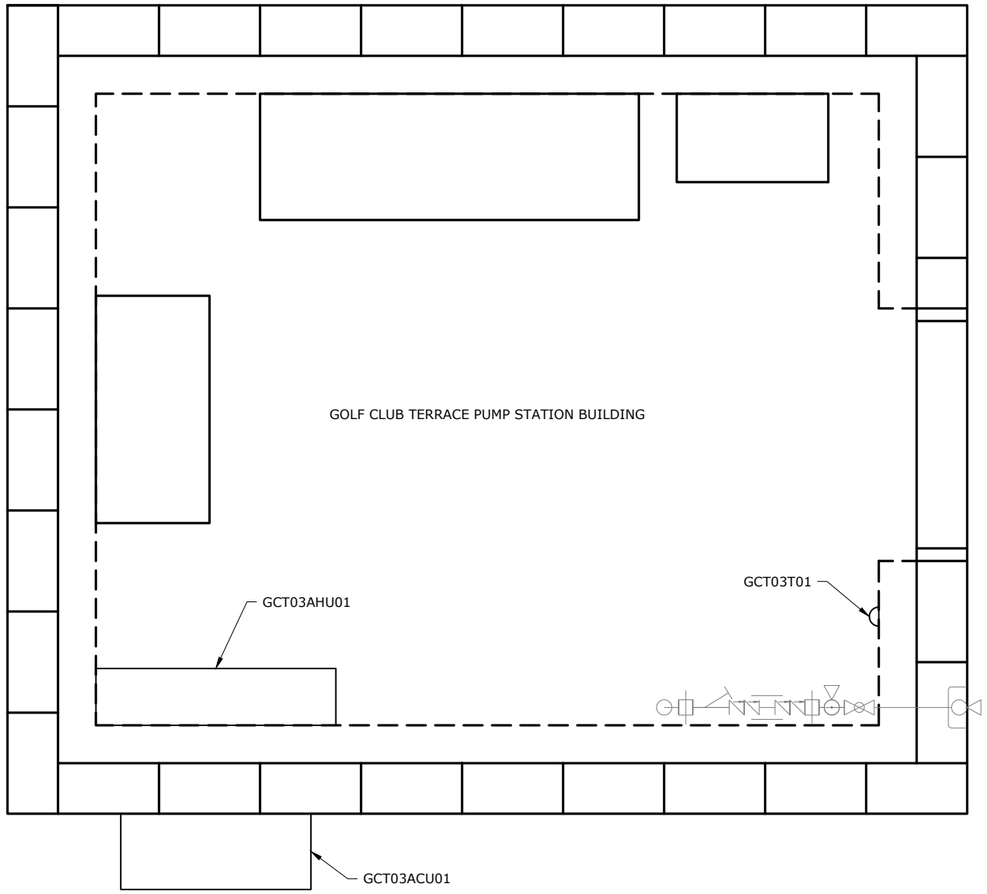
SHEET NOTES:

1. CONTRACTOR TO VERIFY ALL HVAC EQUIPMENT MOUNTING LOCATIONS IN FIELD WITH ENGINEER.

2. CONTRACTOR TO COORDINATE LOCATION OF WALL-MOUNTED UNITS (GCT03AHU01, GCT03ACU1, GCT03T01) WITH EXISTING ELECTRICAL AND PLUMBING.

3. LOCATE ALL CONTROLS, PANELS, AND DISCONNECT SWITCHES APPROXIMATELY 4 FEET ABOVE FINISHED FLOOR. COORDINATE LOCATIONS WITH ELECTRICAL.

4. EQUIPMENT MANUFACTURERS AND MODEL NUMBERS ARE PROVIDED FOR REFERENCE ONLY AND SHALL BE USED TO ESTABLISH EQUIPMENT SIZES AND REQUIRED PERFORMANCE. APPROVED EQUAL MANUFACTURERS WILL BE ACCEPTED.



PLAN
SCALE: 1"=1'

SPLIT SYSTEM HEAT PUMP

TAG NO.	LOCATION	COOLING UNIT TOTAL CAPACITY (BTUH)	HEATING UNIT TOTAL CAPACITY (BTUH)	CONTROL	VOLTS/ PHASE	MANUFACTURER & MODEL
GCT03AHU01	ELEC/CTRL ROOM	17,000	18,000	GCT03T01	208-230 / 1	MRCOOL, EZPRO-18-HP-23016D-0
GCT03ACU01	OUTSIDE	17,000	18,000	GCT03T01		

THERMOSTATS

TAG NO.	LOCATION	TYPE	TEMPERATURE RANGE	MANUFACTURER & MODEL
GCT03T01	ELECTRICAL/CONTROL ROOM	WIRELESS REMOTE	32°F-104°F	MRCOOL, RG10A(D2S)/BGEFU1

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

REGISTERED PROFESSIONAL ENGINEER — OREGON — JUNE 11, 2004 — ALEX M. BARGNESER — RENEWS 12-31-25

SCALE | VERT: AS SHOWN | HORIZ: AS SHOWN
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
ELECTRICAL ROOM HVAC
PLAN AND SCHEDULES

consor

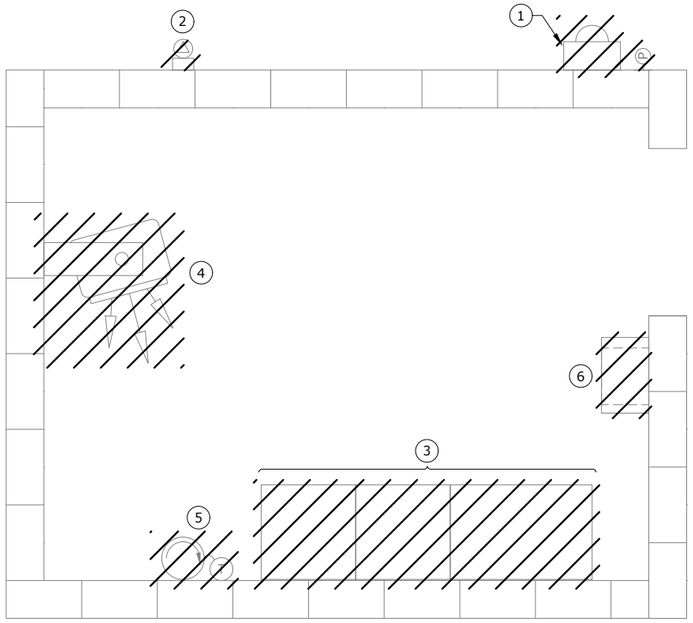
DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

SHEET 3B-H1
82 of 184

G:\PDX_Projects\19\2679 - Clackamas County - WES - Pump Station Rehabilitation and Upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH B-H.dwg 3B-H1 5/8/2025 3:41 PM JACOB.COLES 24.1s (LMS Tech)



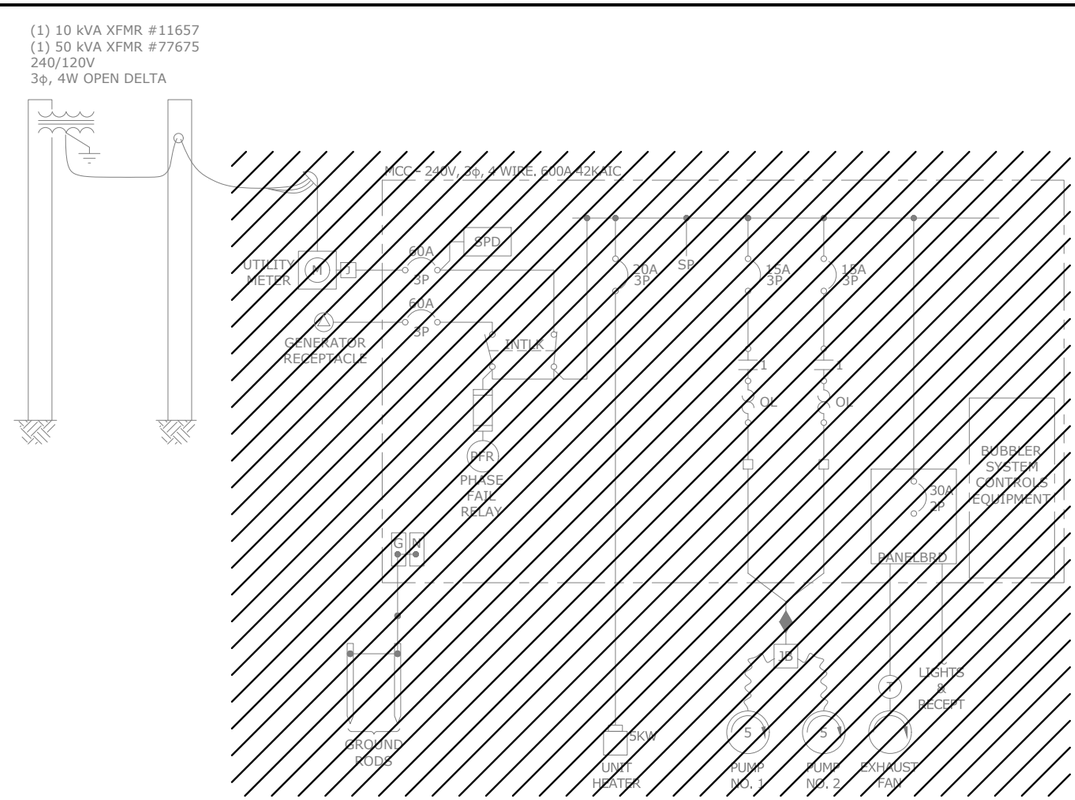
ELECTRICAL DEMO PLAN
SCALE: 3/4"= 1'

GENERAL NOTES

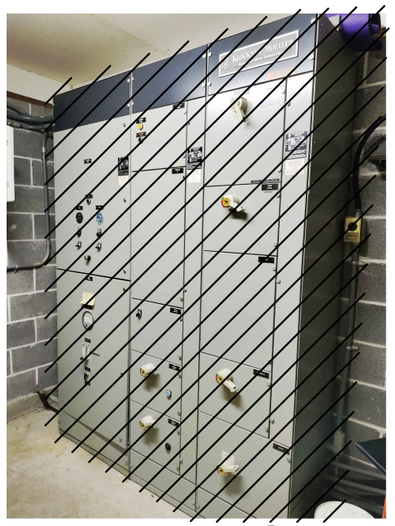
1. EXISTING BUILDING TO BE DEMO'D. CONTACTOR TO REMOVE ALL ELECTRICAL EQUIPMENT CONDUITS AND WIRING. EQUIPMENT SHOWN IS FOR REFERENCING MAJOR EQUIPMENT AND DOES NOT INDICATE ALL ITEMS SUCH AS LIGHTING RECEPTACLES, ETC.
2. CONTRACTOR TO COORDINATE WITH OWNER TO SALVAGE COMPONENTS BEFORE DEMOLITION OCCURS.

KEY NOTES

1. EXISTING UTILITY METER.
2. EXISTING GENERATOR RECEPTACLE.
3. EXISTING MCC WITH PANELBOARD, MOTOR STARTING AND BUBBLER CONTROL EQUIPMENT. SEE DETAIL 1.
4. EXISTING UNIT HEATER TO BE SALVAGED. SEE DETAIL 2.
5. EXISTING EXHAUST FAN. SEE DETAIL 3.
6. EXISTING RADIO AND RTU PANEL EQUIPMENT TO BE SALVAGED AND RE-USED IN NEW RTU PANEL. SEE IC SHEETS FOR ADDITIONAL INFORMATION. SEE DETAIL 4.



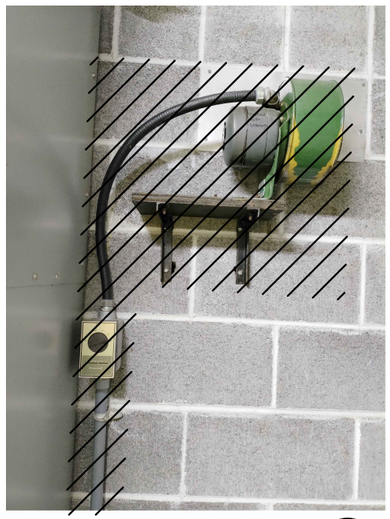
ONE-LINE DIAGRAM - DEMO
SCALE: NTS



MCC ELEV. 1
SCALE: NONE



UNIT HEATER ELEV 2
SCALE: NONE



EXHAUST FAN ELEV. 3
SCALE: NONE



RADIO & RTU ELEV. 4
SCALE: NONE

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

SHEET 3B-E1 83 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2004 MICHAEL E. WALLIS
EXPIRES: 6/30/26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN
NOTICE IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 – 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
ELECTRICAL
DEMOLITION PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

P:\Projects\20.18.02_MSA_WES_Final_Design\DWG\Group 3\3B-E1-Golf Club Terrace.dwg 3B-E1 5/6/2025 1:34 PM ROBERTC 23.1s (LMS Tech)

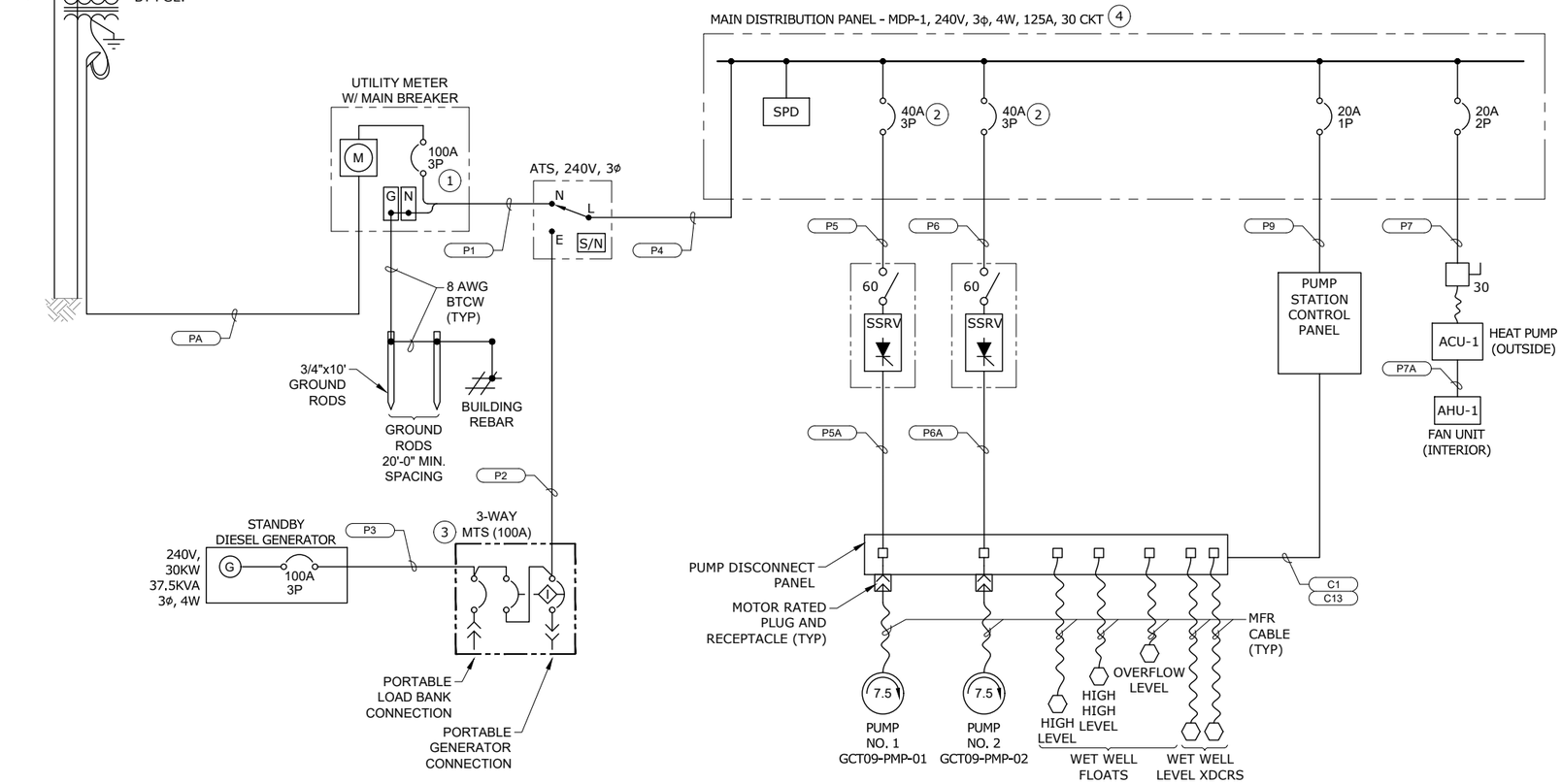
LOAD SUMMARY		LOAD		
QTY.	DESCRIPTION	HP	KVA	AMPS @ 240 VAC
	MOTOR LOADS			
1	PUMP #1	7.5	7.9 KVA	19.0 Amps
1	PUMP #2	7.5	7.9 KVA	19.0 Amps
	OTHER LOADS			
1	HVAC AHU-1		3.7 KVA	15.5 Amps
1	MISC LOADS *		2.2 KVA	9.2 Amps
	* - AMP LOAD IS 1-PHASE			
	SUBTOTAL		**21.7**	**62.7**
	LARGEST MOTOR X 25%		2.0 KVA	4.7 Amps
	NON-MOTOR LOADS X 25%		1.5 KVA	3.5 Amps
	TOTAL		**25.1 KVA**	**71.0 Amps**

LOAD SUMMARY

SCALE: NTS

KEY NOTES

1. PROVIDE WARNING SIGN READING "UTILITY SERVICE DISCONNECT DOES NOT DISCONNECT GENERATOR".
2. VERIFY SIZE WITH MANUFACTURER OF SOFT STARTER PROVIDED.
3. 3-WAY MANUAL TRANSFER SWITCH WITH CAM-LOCK CONNECTORS.
4. "B" PHASE IS "WILD LEG" - 120V CONNECTIONS ARE NOT TO USE THIS PHASE.



ONE-LINE DIAGRAM - NEW

SCALE: NTS

NO.	DATE	REVISION	BY
		DESIGNED: RSC	
		DRAWN: RSC	
		CHECKED: NEW	
		APPROVED: MEW	

SHEET 3B-E2 84 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2010 MICHAEL E. WELLS
EXPIRES: 6/30/26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN
NOTICE IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 — 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
ELECTRICAL
ONE-LINE DIAGRAM

consor

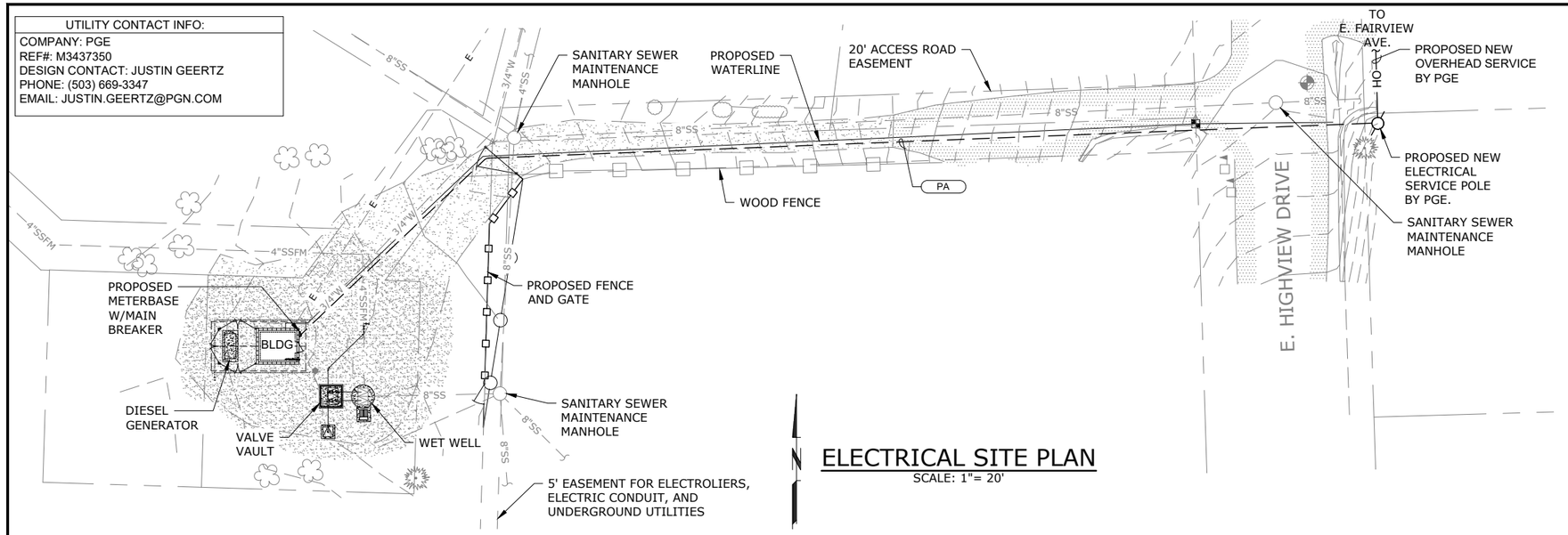
DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

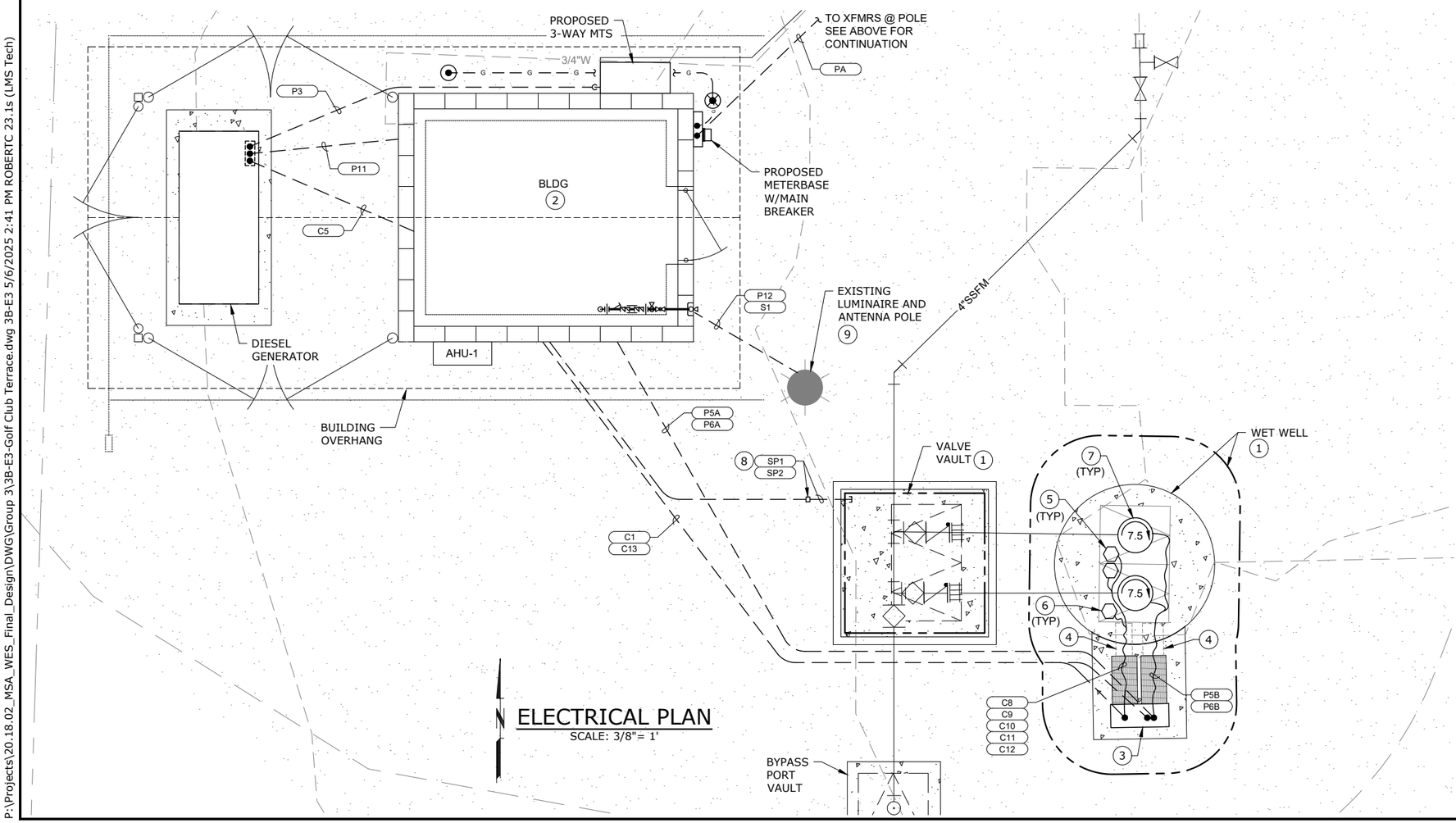
Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

P:\Projects\20.18.02_MSA_WES_Final_Design\DWG\Group 3\3B-E2-Golf Club Terrace.dwg 3B-E2 5/8/2025 12:56 PM ROBERTC 23.1s (LMS Tech)

UTILITY CONTACT INFO:
COMPANY: PGE
REF#: M3437350
DESIGN CONTACT: JUSTIN GEERTZ
PHONE: (503) 669-3347
EMAIL: JUSTIN.GEERTZ@PGN.COM



ELECTRICAL SITE PLAN
SCALE: 1"= 20'



ELECTRICAL PLAN
SCALE: 3/8"= 1'

GENERAL NOTES

1. SEE SHEET 3B-E5 FOR CONDUIT AND CIRCUIT SCHEDULE.
2. SERVICE DESIGN IS BASED ON PRELIMINARY DESIGN PROVIDED BY PGE. CONTRACTOR TO VERIFY AND COORDINATE WITH PGE'S FINALIZED DESIGN. SEE UTILITY CONTACT INFORMATION THIS SHEET.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WORK NOT PERFORMED BY PGE, INCLUDING TRENCHING, BACKFILLING AND CONDUIT INSTALLATION.
4. INSTALLATION TO BE PER PGE'S LATEST ELECTRICAL SERVICE REQUIREMENTS.
5. COORDINATE ALL INSPECTION WITH PGE. CONDUIT INSTALLATIONS MUST BE INSPECTED AND APPROVED BY PGE PRIOR TO BACKFILLING.
6. CONTRACTOR TO PROVIDE ALL NECESSARY EQUIPMENT SUBMITTALS FOR APPROVAL BY PGE.

KEY NOTES

1. CLASS 1 DIV. 2 GROUP D SPACE IN AN ENVELOPE 18" ABOVE GRADE 3' LATERALLY FROM TRENCH AND SLEEVE OPENINGS FOR WET WELL AND CLASS 1 DIV. 2 GROUP D SPACE INSIDE OF VALVE VAULT. INTERIOR OF WET WELL IS CLASS 1 DIV. 1 GROUP D SPACE
2. SEE SHEET 3B-E4 FOR BUILDING ELECTRICAL EQUIPMENT CONNECTION PLAN.
3. PUMP DISCONNECT PANEL WITH PUMP RECEPTACLES AND PLUGS. SEE SHEET 3B-E8.
4. PUMP CABLING TRENCH WITH PIPE SLEEVE FOR ROUTING OF PUMP AND LEVEL CONTROLS MANUFACTURER'S CABLES. SEE SHEETS 3B-M1 AND 3B-M2.
5. WET WELL LEVEL SENSORS, PT-1001 & PT-1002 IN STILLING WELLS. SEE SHEETS 3B-M1, 3B-M2 AND 3-GD6 FOR LOCATION AND INSTALLATION INFORMATION.
6. FLOAT SWITCHES, LSH-1010, LSHH-1010, LSHH-1011 IN WET WELL. SEE SHEET 3B-M1, 3B-M2 AND 3-GD6 FOR LOCATION AND INSTALLATION INFORMATION.
7. SUBMERSIBLE PUMPS WITH MFR CABLING ROUTED TO PUMP DISCONNECT PANEL VIA CABLE TRENCH AND SLEEVES.
8. CONDUITS ARE ENTERING HAZARDOUS AREA; PROVIDE TRANSITION 12" OUTSIDE VAULT FROM PVC TO RGS TO MAINTAIN CONTINUOUS CONDUITS TO FUTURE SEAL OFFS. SEAL AND CAP FOR FUTURE INSIDE VAULT AND INTERIOR NEXT TO PUMP STATION CONTROL PANEL.
9. REMOVE EXISTING CONDUIT AND ALARM BEACON ON EXISTING POLE. REPLACE EXISTING LUMINAIRE WITH LUMINAIRE 'C', SEE SHEET 3B-E4 FOR SCHEDULE AND COORDINATE MOUNTING BRACKET AS NEEDED TO ADJUST AMING. INTERCEPT EXISTING ANTENNA CONDUIT AT BASE OF POLE AND RE-ROUTE TO NEW PUMP STATION CONTROL PANEL. INTERCEPT EXISTING LIGHTING CONDUIT AT BASE OF POLE AND RE-ROUTE TO NEW SWITCH INTERIOR TO STATION.

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AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

SHEET 3B-E3 85 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2004 MICHAEL E. WELLS
EXPIRES: 6/30/26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN
NOTICE 0 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
ELECTRICAL
SITE PLAN

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

P:\Projects\20.18.02_MSA_WES_Final_Design\DWG\Group 3\3B-E3-Golf Club Terrace.dwg 3B-E3 5/6/2025 2:41 PM ROBERTC 23.1s (LMS Tech)

KEY NOTES

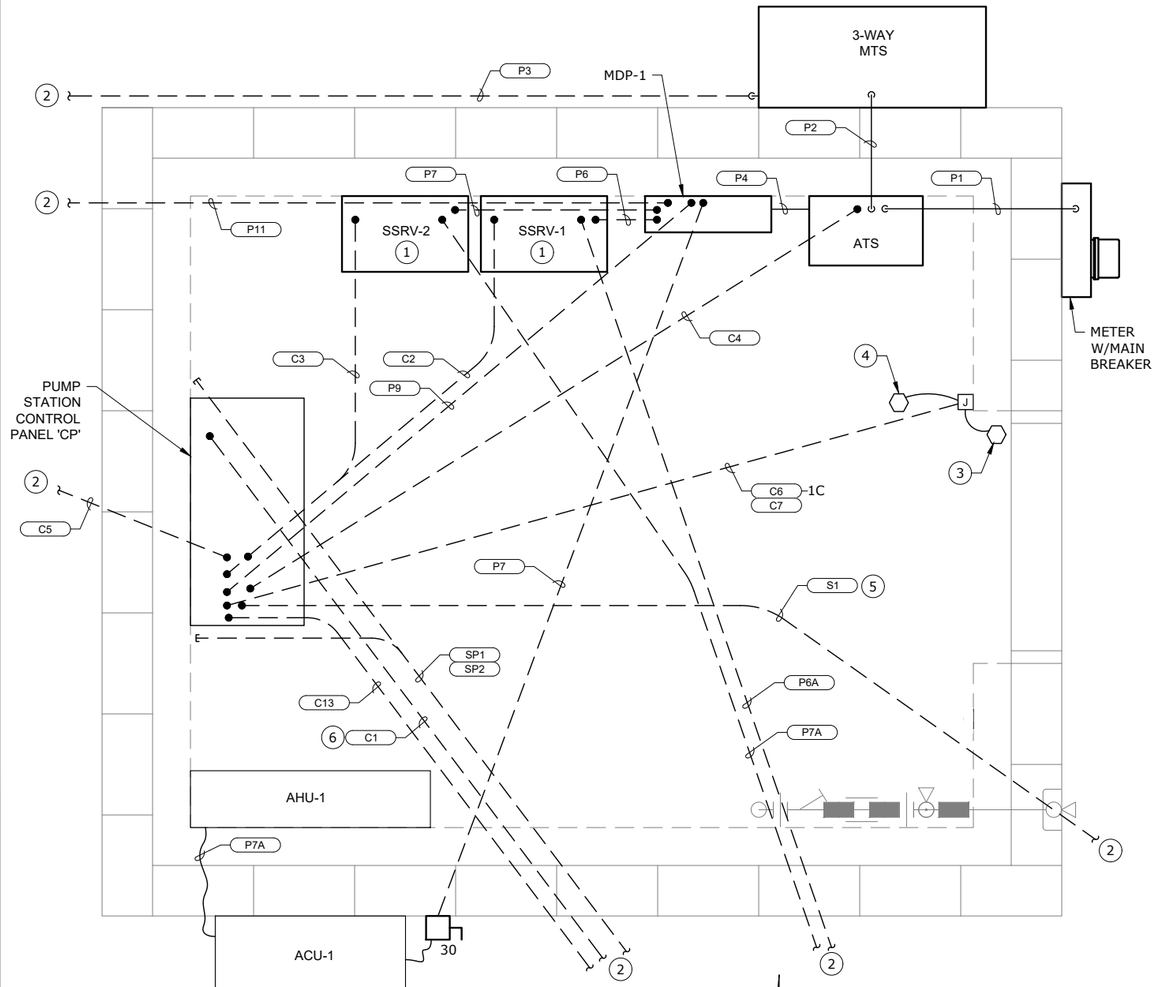
1. SOFT STARTER PANELS. SEE SHEETS 3B-E6 & 3B-E7.
2. SEE SHEET 3B-E3 FOR CONTINUATION.
3. INTRUSION SWITCH MOUNTED AT TOP OF DOOR LOCATION AND CONNECT TO PUMP STATION CONTROL PANEL.
4. CEILING MOUNT NEW SMOKE DETECTOR AND CONNECT TO PUMP STATION CONTROL PANEL.
5. RE-CONNECT EXISTING CABLING FROM RADIO ANTENNA LOCATED ON EXTERIOR POLE. REPLACE CABLING IF NOT LONG ENOUGH TO REACH PANEL LOCATION.
6. CONDUIT CONTAINS INTRINSICALLY SAFE CONDUCTORS. ENSURE SEPARATION OF CONDUCTORS FROM NON INTRINSICALLY SAFE CONDUCTORS PER NEC AND ENTER PANEL IN INTRINSIC SAFE DESIGNATED AREA.
7. PROVIDE UNSWITCHED "HOT" CIRCUIT FROM INTERIOR LIGHTING FOR EMERGENCY LIGHT.

GENERAL NOTES

1. SEE IC SHEETS FOR ADDITIONAL CONNECTION INFORMATION.
2. SEE SHEET 3B-E5 FOR CONDUIT AND CIRCUIT SCHEDULE.
3. SEAL ALL CONDUIT PENETRATIONS, WATER-PROOF, FROM EXTERIOR TO INTERIOR OF BUILDING WITH NON-SHRINK GROUT.
4. PURSUANT TO OCEC SECTION 9.4.1.1 EXCEPTION (H), THE INTERIOR LIGHTING IS EXEMPT FROM AUTOMATED LIGHTING CONTROLS TO ENSURE SAFETY OF OPERATIONS PERSONNEL.
5. PROVIDE LABELING AT SWITCHES INDICATING EQUIPMENT CONTROLLED BY SWITCH, IE. "INT, EXT, AREA".
6. MOUNT EMERGENCY LUMINAIRE AND EXTERIOR BUILDING LUMINAIRE AT APPROX. 8' ABOVE GRADE.

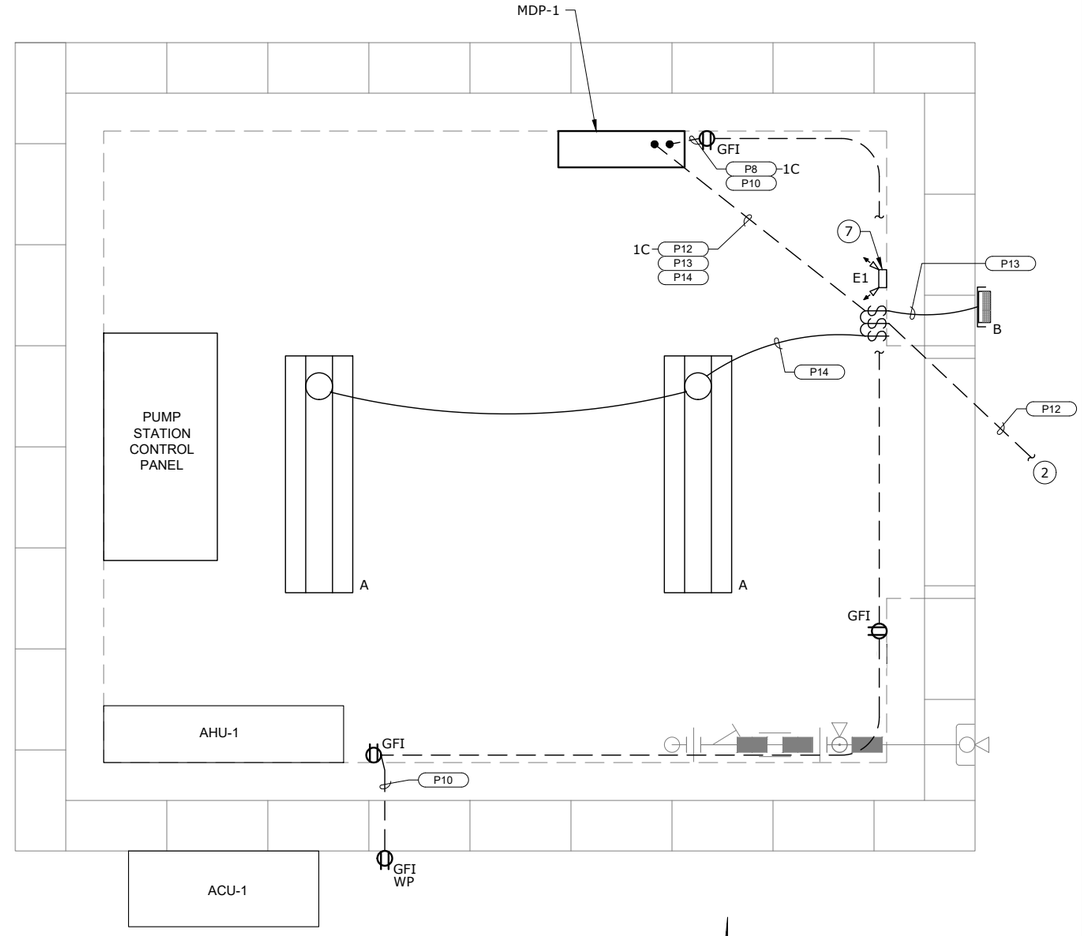
LUMINAIRE SCHEDULE

TYPE	DESCRIPTION	MOUNTING	VOLTAGE	INPUT WATTS	MANUFACTURER PART NUMBER	BATTERY BACKED	COLOR TEMP	LAMP TYPE LUMENS	NOTES
A	4' LOW PROFILE ENCLOSED AND GASKETED INDUSTRIAL LED. MOLDED FIBERGLASS HOUSING, ACRYLIC LINEAR RIBBED FROSTED LENS, 80CRI, WIDE DISTRIBUTION, 0-10V DIMMING, U.L. LISTED FOR WET LOCATIONS.	SURFACE	120/277V	18	LITHONIA LIGHTING: FEM LED SERIES OR AS APPROVED.	NO	40K	LED 2,741	
B	LED WALL LUMINAIRE. SINGLE-PIECE ALUMINUM HOUSING WITH ONE-PIECE DOOR FRAME GASKET, IP66 RATING. ZERO UPLIGHT WIDE DISTRIBUTION OPTICS, 80CRI W/PHOTOCELL	SURFACE	120/277V	10	LITHONIA LIGHTING: WDGE2 LED SERIES OR AS APPROVED.	NO	40K	LED 1,289	
C	HIGH PERFORMANCE LED, WET LOCATION FLOOD LIGHT WITH BRONZE DIE CAST ALUMINUM HOUSING AND INTERNAL HEAT SINK. DUAL ENGINE PACKAGE WITH WIDE FLOOD RECTANGLE DISTRIBUTION AND PHOTOCELL.	POLE	120/277V	42	LITHONIA LIGHTING: DSXF1 LED SERIES OR AS APPROVED.	NO	40K	LED 5,573	PROVIDE WITH THK 1/2" NPT KNUCKLE
E1	DUAL HEAD LED, 12V, 27W, LEAD CALCIUM BATTERY BACKED LUMINAIRE WITH 20 GAUGE STEEL CABINET. 90 MINUTE RUN-TIME, CAPABLE OF POWERING MULTIPLE REMOTE HEADS W/ TEST SWITCH AND STATUS INDICATOR.	WALL MOUNTED	120/277V	27	ISOLITE: ELL-LC-12V27W-WH-MB-2-XRH-MT-L127	YES	N/A	LED	



ELECTRICAL BUILDING PLAN

SCALE: 1"= 1'



ELECTRICAL LIGHTING & RECEPT PLAN

SCALE: 1"= 1'

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NO. | DATE | REVISION | BY
DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

SHEET 3B-E4 86 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2019 MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN
NOTICE IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 – 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 – SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
ELECTRICAL
BUILDING PLANS

consor
DATE: MAY 2025
19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES
PROJECT:

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ALL CIRCUITS ARE IDENTIFIED ON THE PLANS WITH THE DIAMOND SYMBOL. CONDUCTOR SIZES ARE BASED ON COPPER CONDUCTORS. CONDUIT SIZES ARE SHOWN FOR CASES WHEN CIRCUIT CONDUCTORS ARE RUN WITHOUT OTHER CIRCUITS. MULTIPLE CIRCUITS RUN IN COMMON CONDUITS ARE SHOWN ON PLANS AND SUPERSEDE THE BASIC CONDUIT SIZE SHOWN.

RACEWAY SIZES ARE IN INCHES WITH QUANTITIES IN EXCESS OF (1) SHOWN IN ADJACENT PARENTHESIS. CONDUCTOR CONFIGURATIONS ARE CODED AS FOLLOWS: P- FOR POWER CONDUCTORS, G - FOR GROUND CONDUCTORS, N - FOR NEUTRAL CONDUCTORS, C - FOR CONTROL CONDUCTORS, TSP - FOR TWISTED SHIELDED PAIR, AND SP - FOR SPARE CONDUCTORS.

CIRCUITS REVISED SINCE LAST ISSUE ARE INDICATED BY AN ASTERISK(*).

CIRCUIT NUMBER	FROM	TO	CONDUCTORS	RACEWAY	NOTES
PA	NEW UTLITY PRIMARY POWER POLE W/ TRANSFORMERS	METERBASE W/ MAIN BREAKER	PULL CORD	4	CONDUCTORS BY UTILITY
P1	METERBASE W/ MAIN BREAKER	AUTOMATIC TRANSFER SWITCH (ATS)	(3) 2 AWG, P (1) 2 AWG, N	1.25	
P2	ATS	3-WAY MANUAL TRANSFER SWITCH (MTS)	(3) 2 AWG, P (1) 2 AWG, N (1) 8 AWG, G	1.25	
P3	3-WAY MTS	GENERATOR	(3) 2 AWG, P (1) 2 AWG, N (1) 8 AWG, G	1.25	
P4	ATS	MDP-1	(3) 2 AWG, P (1) 2 AWG, N (1) 8 AWG, G	1.25	
P5	MDP-1	SSRV 1 CONTROL PANEL	(3) 8 AWG, P (1) 10 AWG, G	3/4	
P5A	SSRV 1 CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(3) 10 AWG, P (1) 18 AWG, TSP (1) 10 AWG, G	1	PUMP 1 POWER PUMP THERMAL/LEAK CKT
P5B	PUMP DISCONNECT PANEL (PDP)	PUMP 1	MFR CABLE	TRENCH	
P6	MDP-1	SSRV 2 CONTROL PANEL	(3) 8 AWG, P (1) 10 AWG, G	3/4	
P6A	SSRV 2 CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(3) 10 AWG, P (1) 18 AWG, TSP (1) 10 AWG, G	1	PUMP 2 POWER PUMP THERMAL/LEAK CKT
P6B	PUMP DISCONNECT PANEL (PDP)	PUMP 2	MFR CABLE	TRENCH	
P7	MDP-1	AIR CONDENSER UNIT ACU-1	(2) 12 AWG, P (1) 12 AWG, G	3/4	ROUTE VIA DISCONNECT SWITCH
P7A	AIR CONDENSER UNIT ACU-1	AIR HANDLING UNIT AHU-1	MFR CABLING		ROUTED WITH HVAC LINESET
P8	MDP-1	INTERIOR RECEPTACLES	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	1	
P9	MDP-1	PUMP STATION CONTROL PANEL	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
P10	MDP-1	EXTERIOR RECEPTACLE	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	1	
P11	MDP-1	GENERATOR	(2) 12 AWG, P (2) 12 AWG, N (1) 12 AWG, G	3/4	BLOCK HTR / BATTERY CHGR CKT
P12	MDP-1	SWITCHES FOR EXTERIOR LUMINAIRE	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
P13	MDP-1	BLDG EXTERIOR LUMINAIRE VIA SWITCH	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
P14	MDP-1	BLDG INTERIOR LUMINAIRE VIA SWITCH	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
C1	PUMP STATION CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(2) 18 AWG, TSP (6) 14 AWG, C (1) 14 AWG, G	1	NEW LEVEL SENSOR CABLES LO, HI, & HI-HI FLOATS (INSTRINSIC SAFE - KEEP SEPARATE)
C2	PUMP STATION CONTROL PANEL	SSRV 1 CONTROL PANEL	(14) #14 AWG, C (1) #14 AWG, G (2) #14 AWG, SP	1	PUMP 1 CONTROL
C3	PUMP STATION CONTROL PANEL	SSRV 2 CONTROL PANEL	(14) #14 AWG, C (1) #14 AWG, G (2) #14 AWG, SP	1	PUMP 2 CONTROL
C4	PUMP STATION CONTROL PANEL	ATS	(4) 14 AWG, C (1) 14 AWG, G (2) 14 AWG, SP	1	ATS POS SIGNALS
C5	PUMP STATION CONTROL PANEL	GENERATOR	(4) 14 AWG, C (1) 14 AWG, G (2) 14 AWG, SP	1	RUN & FAULT SIGNALS
C6	PUMP STATION CONTROL PANEL	INTRUSION SWITCH	(2) 14 AWG, C (1) 14 AWG, G	3/4	
C7	PUMP STATION CONTROL PANEL	SMOKE DETECTOR	(2) 14 AWG, C (2) 14 AWG, C	3/4	DC POWER SIGNAL CKT
C8	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL SENSOR 1	MFR CABLE	TRENCH	
C9	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL SENSOR 2	MFR CABLE	TRENCH	
C10	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL HIGH FLOAT	MFR CABLE	TRENCH	
C11	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL HIGH HIGH FLOAT	MFR CABLE	TRENCH	
C12	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL OVERFLOW FLOAT	MFR CABLE	TRENCH	
C13	PUMP STATION CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	1	
S1	PUMP STATION CONTROL PANEL	EXIST. ANTENNA @ EXISTING LIGHT POLE	COAX CABLE	1	INTERCEPT AND RE-ROUTE TO NEW PANEL LOCATION. VERIFY CONDUIT SIZE AND COAX TYPE.
SP1	VALVE VAULT	WEST WALL NEAR PUMP STATION CONTROL PANEL	PULL CORD	1	STUB AND CAP
SP2	VALVE VAULT	WEST WALL NEAR PUMP STATION CONTROL PANEL	PULL CORD	1	STUB AND CAP

CIRCUIT SCHEDULE

SCALE: NTS

PANEL: MDP-1	VOLTAGE: 240 3Φ 4W	MOUNTING: SURFACE
LOCATION: ELECTRICAL ROOM	BUS: 125A COPPER	AIC: 14,000
FEEDER:ATS	MAIN:	

CKT NO	CIRCUIT DESCRIPTION	BREAKER POLES	BREAKER AMPS	VA	PHASE	LOAD VA	BREAKER POLES	BREAKER AMPS	CIRCUIT DESCRIPTION	CKT NO
1	SOLID STATE REDUCED VOLTAGE STARTER 1 SSRV-1	3	30	2629.6	A	500	1	20	CONTROL PANEL	2
3	"	-	30	2629.6	B	/	/	/	"WILD LEG" NO NOT USE FOR 120V CONNECTION	4
5	"	-	30	2629.6	C	540	1	20	INTERIOR RECEPTACLES	6
7	SOLID STATE REDUCED VOLTAGE STARTER 2 SSRV-2	3	125	2629.6	A	180	1	20	EXTERIOR RECEPTACLE	8
9	"	-	125	2629.6	B	/	/	/	"WILD LEG" NO NOT USE FOR 120V CONNECTION	10
11	"	-	125	2629.6	C	63	1	20	INTERIOR LIGHTING & EMERG LIGHTING	12
13	SPARE	3	20	-	A	10	1	20	EXTERIOR LIGHTING	14
15	"	-	20	-	B	/	/	/	"WILD LEG" NO NOT USE FOR 120V CONNECTION	16
17	"	-	20	-	C	42	1	20	AREA POLE LIGHTING	18
19	SPARE	1	20	-	A	-	1	20	SPARE	20
21	"WILD LEG" NO NOT USE FOR 120V CONNECTION	/	/	/	B	/	/	/	"WILD LEG" NO NOT USE FOR 120V CONNECTION	22
23	GENERATOR BLOCK HEATER	1	20	600	C	1860	2	20	HVAC AIR CONDENSOR UNIT ACU-1	24
25	BATTERY CHARGER	1	20	240	A	1860	-	20	"	26
27	"WILD LEG" NO NOT USE FOR 120V CONNECTION	/	/	/	B	/	/	/	"WILD LEG" NO NOT USE FOR 120V CONNECTION	28
29	SPACE	-	-	-	C	-	-	-	SPACE	30

LOAD PER PHASE

PHASE A	8.0	KVA
PHASE B	5.3	KVA
PHASE C	8.4	KVA
TOTAL LOAD	21.7	KVA
TOTAL AMPS	52	AMPS

NOTE: PHASE "B" IS "WILD LEG", DO NOT USE FOR 120V CKTS

PANEL SCHEDULE

SCALE: NTS

NO.	DATE	REVISION	BY

SHEET 3B-E5 87 of 184

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2015 MICHAEL E. WELLS
EXPIRES: 6/30/26

VERT.: AS SHOWN
HORIZ.: AS SHOWN
SCALE

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0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
ELECTRICAL
CIRCUIT AND PANEL SCHEDULES

consor

DATE: MAY 2025

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CLACKAMAS WATER ENVIRONMENT SERVICES

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P:\Projects\20.18.02_MSA_WES_Final_Design\DWG\Group 3\3B-E5-Golf Club Terrace.dwg 3B-E5 5/12/2025 10:39 AM ROBERTC 23.1s (LMS Tech)

GENERAL NOTES

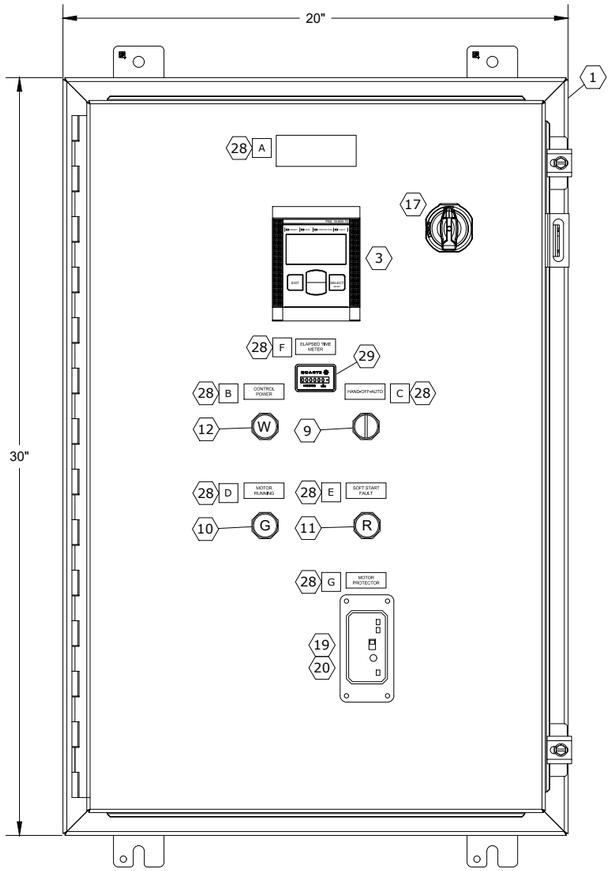
1. PANEL LAYOUT IS CONCEPTUAL AND FINALIZED LAYOUT SHALL BE PER UL 508 REQUIREMENTS AND PROVIDED BY MANUFACTURER.
2. PANEL IS TYPICAL FOR 2 UNITS, SSRV-1 (GCT09-PMP-01) AND SSRV-2 (GCT09-PMP-02).

NAMEPLATE SCHEDULE

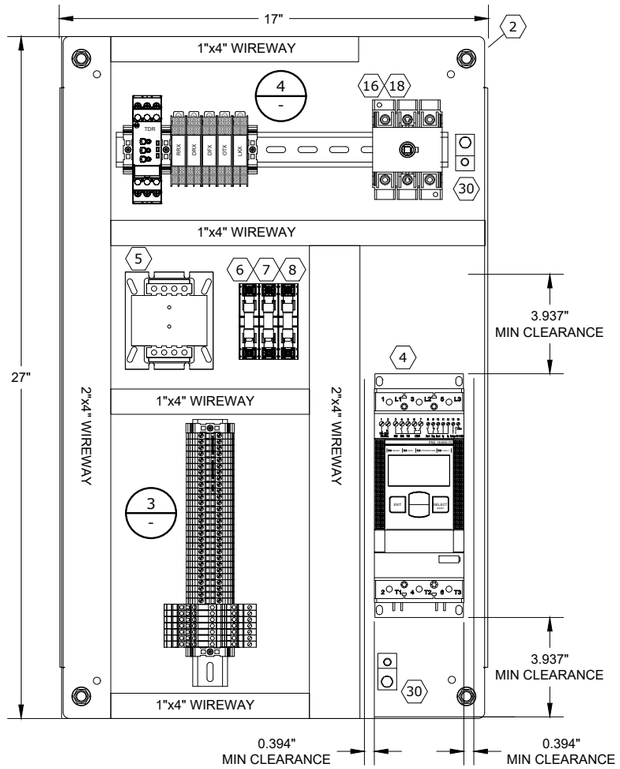
A	ITEM	NAMEPLATE SCHEDULE
	A	GCT09-PMP-0X (X=1-2)
	B	CONTROL POWER
	C	HAND-OFF-AUTO
	D	MOTOR RUNNING
	E	SOFT START FAULT
	F	ELAPSED TIME METER
	G	PUMP PROTECTION RELAY

BILL OF MATERIALS

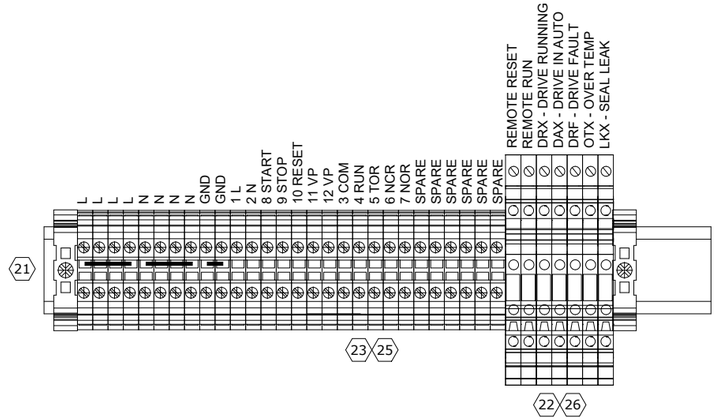
#	ITEM	MANUFACTURER	PART NUMBER	DESCRIPTION
	1	HOFFMAN	A302010LP	ENCLOSURE, 30 x 20 x 10, WALL MOUNT, SINGLE DOOR, NEMA 12
	2	HOFFMAN	A30P20	BACKPANEL, 30 x 20
	3	ABB		EXTERNAL KEYPAD (PSEEK)
	4	ABB	PSE25-600-70	7.5HP (240V) ND CLASS 10 208-600V SOFT START 100-250VAC CONTROL
	5	ALLEN BRADLEY	1497-A-BASX-0-N	CONTROL TRANSFORMER
	6	ALLEN BRADLEY	1491-R171	FUSE BLOCK CLASS CC 0-30A 3 POLE
	7	MERSEN	ATDR1/4	CLASS CC FUSE - PRIMARY - 1/4 AMP
	8	MERSEN	ATDR8/10	CLASS CC FUSE - SECONDARY - 8/10 AMP
	9	ALLEN BRADLEY	800T-J2B	3 POSITION SELECTOR SWITCH
	10	ALLEN BRADLEY	800T-QTH2G	PUSH-TO-TEST, LED, PILOT LIGHT - GREEN
	11	ALLEN BRADLEY	800T-QTH2R	PUSH-TO-TEST, LED, PILOT LIGHT - RED
	12	ALLEN BRADLEY	800T-QTH2W	PUSH-TO-TEST, LED, PILOT LIGHT - WHITE
	13	IDEC	RJ2S-CL-A120	2PDT CONTROL RELAY, 120VAC
	14	IDEC	RJ2S-05BW	2PDT CONTROL RELAY BASE
	15	ALLEN BRADLEY	700-FSM78UU23	GENERAL PURPOSE TIMING RELAY, MULTI FUNCTION
	16	ALLEN BRADLEY	194U-A60-1753	DISCONNECT SWITCH DIN-RAIL MOUNTED, 60 AMP
	17	ALLEN BRADLEY	194E-SY	DISCONNECT SWITCH HANDLE RED/YELLOW
	18	ALLEN BRADLEY	194U-N1	DISCONNECT WITCH SHAFT 12"
	19	FLYGT	14-407129	MINICAS 120 PUMP MOISTURE/TEMPERATURE RELAY
	20	OMRON	P3GA-11	MINICAS 120 PUMP MOISTURE/TEMPERATURE REVERSE RELAY BASE
	21	PHOENIX CONTACT	1201730	DIN Mounting rail - 35mm
	22	PHOENIX CONTACT	3044814	M 4 FEED THROUGH MULTICONDUCTOR, MULTI-LEVEL TERMINAL
	23	PHOENIX CONTACT	3044102	M 4/6 FEED THROUGH TERMINAL - GREY
	24	PHOENIX CONTACT	3044128	M 4/6 GROUND TERMINAL - GREEN/YELLOW
	25	PHOENIX CONTACT	3047028	END SECTION - GREY
	26	PHOENIX CONTACT	3030271	ASSEMBLED JUMPER BAR 10 POLES
	27	PHOENIX CONTACT	0800886	END STOP - GREY
	28			1" x 2" WHITE LETTERS ON BLACK PHENOLIC NAMEPLATE (SEE SCHEDULE)
	29	TRUMETER	722-0002	6-DIGIT HOUR TIMEMETER INCUDING 10'THS OF HOUR
	30	BURNDY	KA2U	GROUNDING LUG #14 TO #2



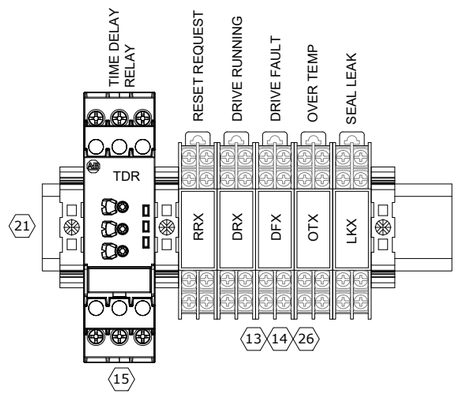
SSRV ENCLOSURE LAYOUT (1)
SCALE: 4" = 1'-0"



SSRV BACKPANEL LAYOUT (2)
SCALE: 4" = 1'-0"



TERMINAL LAYOUT (3)
SCALE: NTS



RELAY LAYOUT (4)
SCALE: NTS

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CHECKED: NEW
APPROVED: MEW

SHEET 3B-E6 88 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2010 MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ.: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
ELECTRICAL
SOFT STARTER PANEL LAYOUT

consor

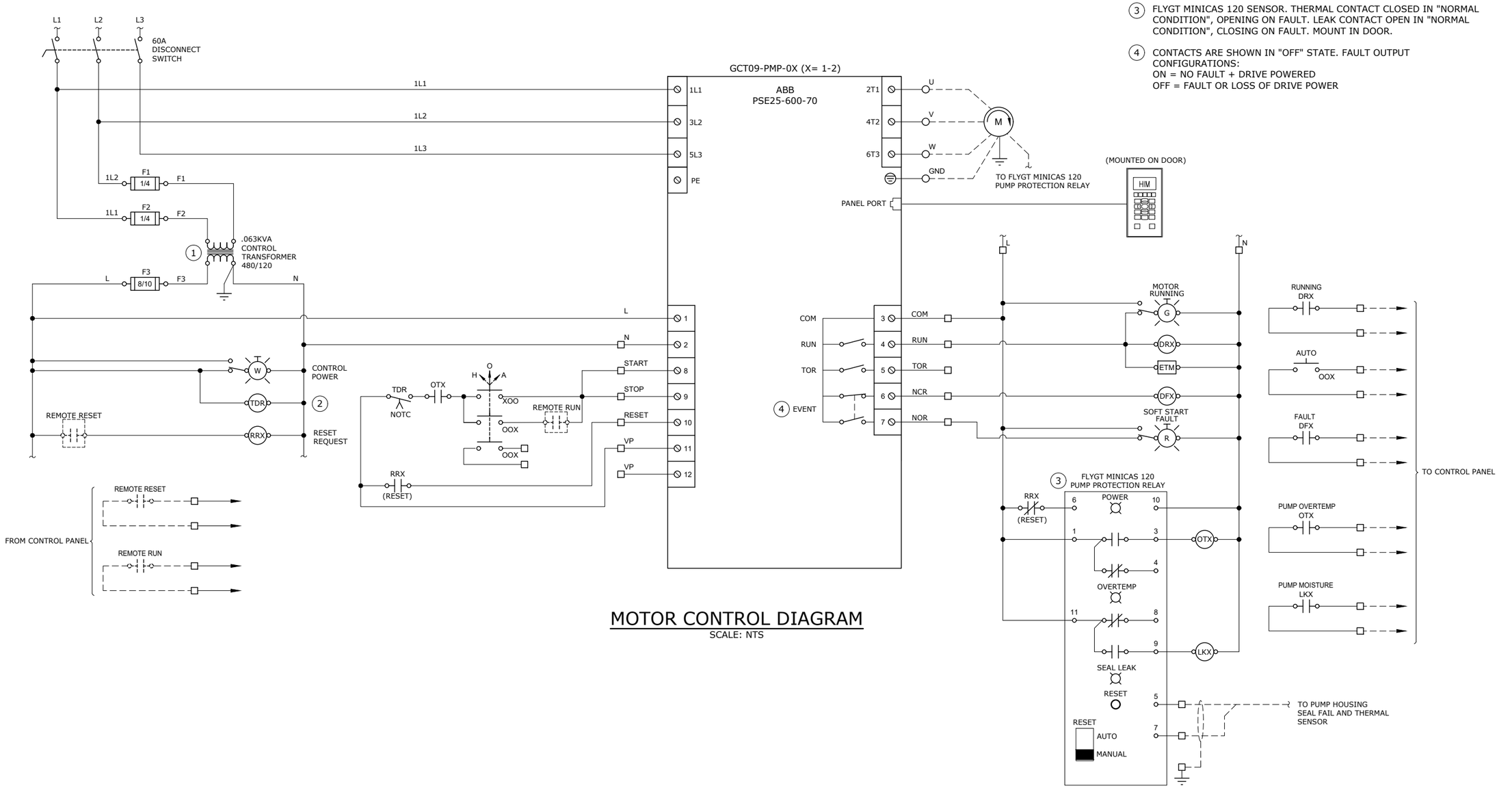
DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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KEY NOTES

1. FUSING AND CPT SIZED PER PANEL DESIGN PROVIDED ON SIMILAR PREVIOUS PROJECTS. VERIFY AND MODIFY IF REQUIRED.
2. "DELAY ON ENERGIZE" TIME DELAY RELAY, 0-60 SECOND TIMER SET AT 15, & 30 SECONDS FOR PUMPS 1 & 2 RESPECTIVELY.
3. FLYGT MINICAS 120 SENSOR. THERMAL CONTACT CLOSED IN "NORMAL CONDITION", OPENING ON FAULT. LEAK CONTACT OPEN IN "NORMAL CONDITION", CLOSING ON FAULT. MOUNT IN DOOR.
4. CONTACTS ARE SHOWN IN "OFF" STATE. FAULT OUTPUT CONFIGURATIONS:
   ON = NO FAULT + DRIVE POWERED
   OFF = FAULT OR LOSS OF DRIVE POWER



MOTOR CONTROL DIAGRAM

SCALE: NTS

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

SHEET 3B-E7 89 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2010 MICHAEL E. WALLIS
EXPIRES: 6/30/26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

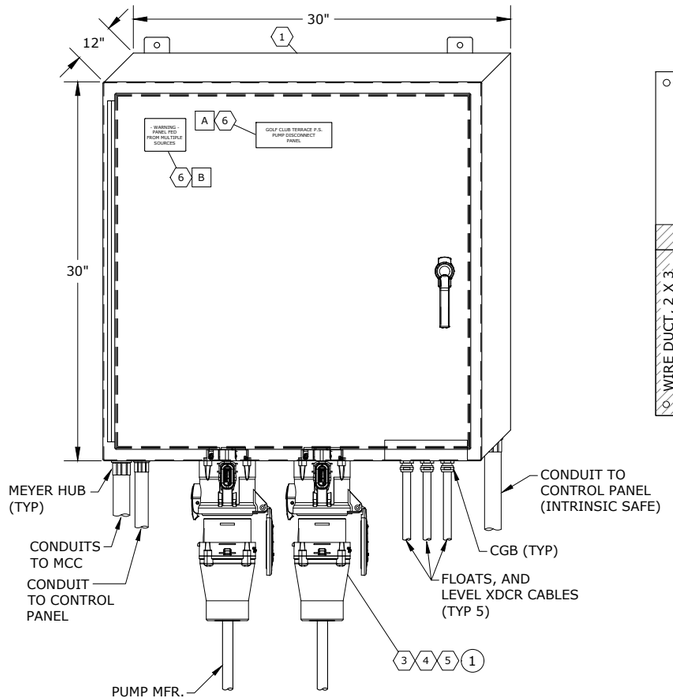
GOLF CLUB TER PUMP STATION
ELECTRICAL
SOFT STARTER WIRING DIAGRAM

consor

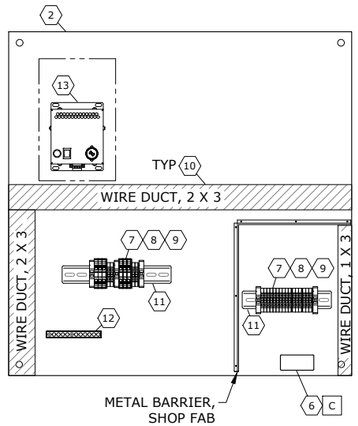
CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

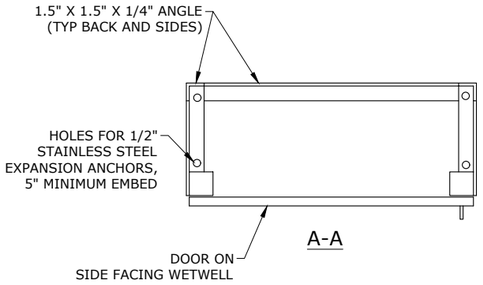
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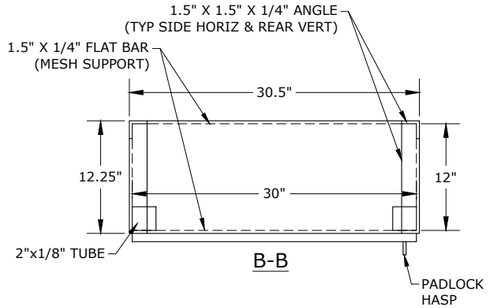
FRONT VIEW
NTS



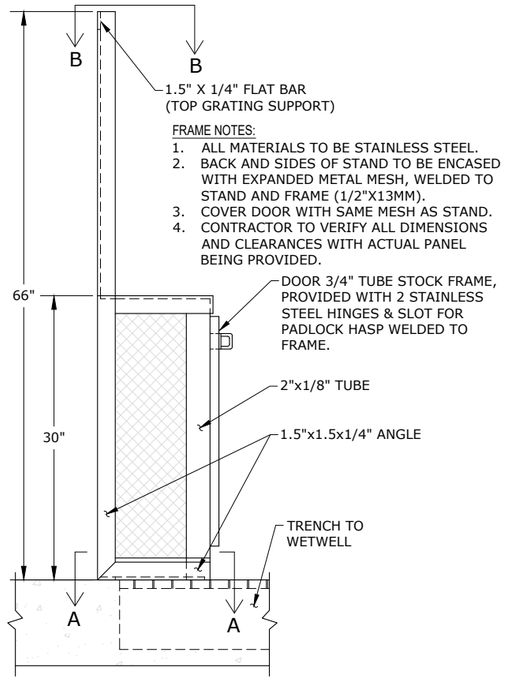
INTERIOR VIEW
NTS



A-A

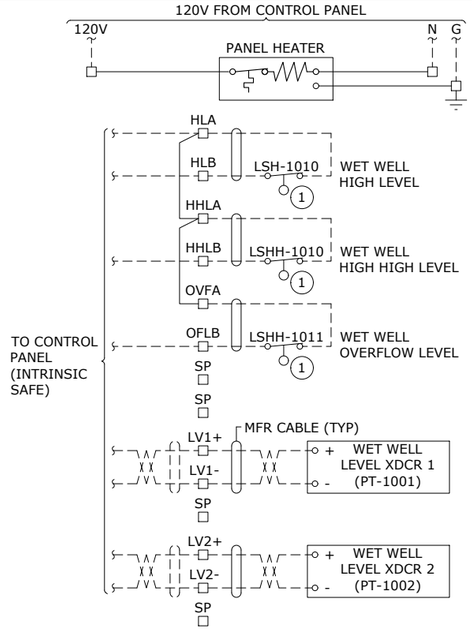


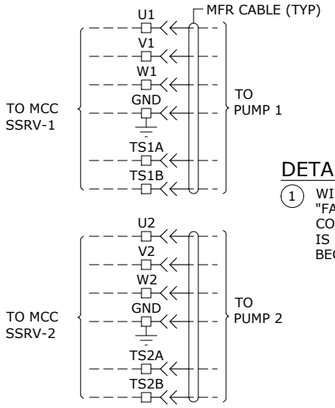
B-B



FRAME NOTES:
1. ALL MATERIALS TO BE STAINLESS STEEL.
2. BACK AND SIDES OF STAND TO BE ENCASED WITH EXPANDED METAL MESH, WELDED TO STAND AND FRAME (1/2"X13MM).
3. COVER DOOR WITH SAME MESH AS STAND.
4. CONTRACTOR TO VERIFY ALL DIMENSIONS AND CLEARANCES WITH ACTUAL PANEL BEING PROVIDED.

PUMP DISCONNECT PANEL STAND
SCALE: NONE
2
-





DETAIL NOTES

1. WIRE FLOAT FOR "FAIL-SAFE" OPERATION. CONTACT OPENS IF FLOAT IS LIFTED OR IF WIRE BECOMES DISCONNECTED.

PUMP DISCONNECT PANEL WIRING
SCALE: NONE
3
-

DETAIL NOTES

1. LABEL PUMP PLUGS AND PUMP RECEPTACLES WITH POLYPROPYLENE DYMO OR BRADY AGGRESSIVE ADHESIVE $\frac{3}{4}$" HIGH LABELS. LABEL AS "P1", AND "P2" WITH A MINIMUM SIZE 5 FONT.

A	ITEM	NAMEPLATE SCHEDULE
	A	GOLF CLUB TERRACE P.S. PUMP DISCONNECT PANEL
	B	-WARNING- PANEL FED FROM MULTIPLE SOURCES
	C	INTRINSICALLY SAFE AREA

#	ITEM	QUANTITY	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	EQUALS ALLOWED
	1	1	NEMA 4 ENCLOSURE, 30"x30"x12"	SAGINAW	SCE-30EL3012SSLPPL	YES
	2	1	BACK PANEL	SAGINAW	SCE-30P30	YES
	3	2	PUMP RECEPTACLE (HP RATED SWITCH) W/AUX CONTACTS	MELTRIC	DSN SERIES	YES
	4	2	PUMP INLET (HP RATED) W/AUX CONTACTS	MELTRIC	DSN SERIES	YES
	5	2	INLET ACCESSORY HANDLE (SIZED FOR PUMP CABLE)	MELTRIC	DSN SERIES	YES
	6	3	PHENOLIC NAMEPLATE (SEE NAMEPLATE SCHEDULE)	PANEL FABRICATOR CHOICE		YES
	7	A/R	TERMINAL BLOCK (NON FUSED)	PANEL FABRICATOR CHOICE		YES
	8	A/R	TERMINAL BLOCK END STOP	PANEL FABRICATOR CHOICE		YES
	9	A/R	TERMINAL BLOCK END PLATE	PANEL FABRICATOR CHOICE		YES
	10	A/R	WIREWAY (SIZE AS NOTED ON DRAWING)	PANEL FABRICATOR CHOICE		YES
	11	A/R	DIN RAIL	PANEL FABRICATOR CHOICE		YES
	12	1	GROUND BUS	EATON C-H	GBK10	YES
	13	1	HEATER W/T-STAT, 125W	SAGINAW	SCE-HF1251A	YES

LAYOUT AND BILL OF MATERIALS
SCALE: NONE
1
-

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

SHEET 3B-E8 90 of 184

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

REGISTERED PROFESSIONAL ENGINEER OREGON MAY 14, 2004 MICHAEL E. WELLS 88305PE
EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ: AS SHOWN

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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
PUMP DISCONNECT PANEL

consor

DATE: MAY 2025

19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT:

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HMI

ATS IN GEN. POSITION YI 2010
ATS IN UTILITY POSITION YI 2010A
GEN. RUNNING YI 2011
GEN. FAULT YA 2012
SMOKE YS 1001
BUILD INT. YS 1002
WETWELL LEVEL A LI 1001
WETWELL LEVEL B LI 1002
WETWELL LEVEL HIGH LSH 1010
WETWELL LEVEL HIGH HIGH LSHH 1010A
WETWELL OVERFLOW LSHH 1011

TYPICAL 1 OF 2
HOA IN AUTO YI 1111A
RUNNING YI 1111B
FAULT YA 1111A
OVER TEMP YA 1111B
MOISTURE LEAK YA 1111C
RUN COMMAND YC 1111A
FAULT RESET COMMAND YC 1111B

PLC

1112

IB

SS 1
SS 2

PT 1001
PT 1002
LSH 1010
LSHH 1010
LSHH 1011

4" FM TO DISCHARGE MH
4" FM
PI 1111
PI 1112
4" FM
4" DR
4" FM
VALVE VAULT
TO BYPASS PORT
4HP
4HP
WET WELL
8" SS
INFLUENT MANHOLE

ATS
STATION ATS
GCT32-ATS-01

GEN
STATION GENERATOR
GCT32-GEN-01

YS 1001
SMOKE
GCT32-SMK-01

YS 1002
BUILDING INTRUSION

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NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC1 91 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — DEC. 17, 2024 — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION P&ID

consor

DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679

PORTLAND Engineering Inc.

I/O	Description	Channel	Loop Sheet
AI	SPARE	SLOT 1, CH 0	3B-IC6
AI	WET WELL LEVEL 1	SLOT 1, CH 1	3B-IC6
AI	WET WELL LEVEL 2	SLOT 1, CH 2	3B-IC6
AI	SPARE	SLOT 1, CH 3	3B-IC6
AI	SPARE	SLOT 1, CH 4	3B-IC6
AI	SPARE	SLOT 1, CH 5	3B-IC6
AI	SPARE	SLOT 1, CH 6	3B-IC6
AI	SPARE	SLOT 1, CH 7	3B-IC7
DI	POWER FAIL RELAY	SLOT 2, CH 0	3B-IC7
DI	POWER SUPPLY 1 STATUS	SLOT 2, CH 1	3B-IC7
DI	POWER SUPPLY 2 STATUS	SLOT 2, CH 2	3B-IC7
DI	ATS IN GEN POSITION	SLOT 2, CH 3	3B-IC7
DI	ATS IN UTILITY POSITION	SLOT 2, CH 4	3B-IC7
DI	GENERATOR RUNNING	SLOT 2, CH 5	3B-IC7
DI	GENERATOR FAULT	SLOT 2, CH 6	3B-IC7
DI	SPARE	SLOT 2, CH 7	3B-IC7
DI	PUMP 1 LEAK ALARM	SLOT 2, CH 8	3B-IC8
DI	PUMP 1 OVER TEMP	SLOT 2, CH 9	3B-IC8
DI	PUMP 1 HOA IN AUTO	SLOT 2, CH 10	3B-IC8
DI	PUMP 1 RUNNING	SLOT 2, CH 11	3B-IC8
DI	PUMP 1 FAULT	SLOT 2, CH 12	3B-IC8
DI	SPARE	SLOT 2, CH 13	3B-IC8
DI	SPARE	SLOT 2, CH 14	3B-IC8
DI	SPARE	SLOT 2, CH 15	3B-IC8

I/O	Description	Channel	Loop Sheet
DI	BUILDING SMOKE ALARM	SLOT 3, CH 0	3B-IC9
DI	BUILDING INTRUSION	SLOT 3, CH 1	3B-IC9
DI	WET WELL HIGH FLOAT	SLOT 3, CH 2	3B-IC9
DI	WET WELL HIGH HIGH FLOAT	SLOT 3, CH 3	3B-IC9
DI	WET WELL OVER FLOW FLOAT	SLOT 3, CH 4	3B-IC9
DI	SPARE	SLOT 3, CH 5	3B-IC9
DI	SPARE	SLOT 3, CH 6	3B-IC9
DI	SPARE	SLOT 3, CH 7	3B-IC9
DI	PUMP 2 LEAK ALARM	SLOT 3, CH 8	3B-IC10
DI	PUMP 2 OVER TEMP	SLOT 3, CH 9	3B-IC10
DI	PUMP 2 HOA IN AUTO	SLOT 3, CH 10	3B-IC10
DI	PUMP 2 RUNNING	SLOT 3, CH 11	3B-IC10
DI	PUMP 2 FAULT	SLOT 3, CH 12	3B-IC10
DI	SPARE	SLOT 3, CH 13	3B-IC10
DI	SPARE	SLOT 3, CH 14	3B-IC10
DI	SPARE	SLOT 3, CH 15	3B-IC10
DO	PUMP 1 RUN COMMAND	SLOT 4, CH 0	3B-IC11
DO	PUMP 1 RESET COMMAND	SLOT 4, CH 1	3B-IC11
DO	PUMP 2 RUN COMMAND	SLOT 4, CH 2	3B-IC11
DO	PUMP 2 RESET COMMAND	SLOT 4, CH 3	3B-IC11
DO	SPARE	SLOT 4, CH 4	3B-IC11
DO	SPARE	SLOT 4, CH 5	3B-IC11
DO	SPARE	SLOT 4, CH 6	3B-IC11
DO	SPARE	SLOT 4, CH 7	3B-IC11
DO	ALARM 1 TO TELEMETRY PLC	SLOT 4, CH 8	3B-IC12
DO	ALARM 2 TO TELEMETRY PLC	SLOT 4, CH 9	3B-IC12
DO	ALARM 3 TO TELEMETRY PLC	SLOT 4, CH 10	3B-IC12
DO	ALARM 4 TO TELEMETRY PLC	SLOT 4, CH 11	3B-IC12
DO	ALARM 5 TO TELEMETRY PLC	SLOT 4, CH 12	3B-IC12
DO	ALARM 6 TO TELEMETRY PLC	SLOT 4, CH 13	3B-IC12
DO	ALARM 7 TO TELEMETRY PLC	SLOT 4, CH 14	3B-IC12
DO	ALARM 8 TO TELEMETRY PLC	SLOT 4, CH 15	3B-IC12

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC2
92 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — DEC. 17, 2024

EXPIRES: 06/30/2026

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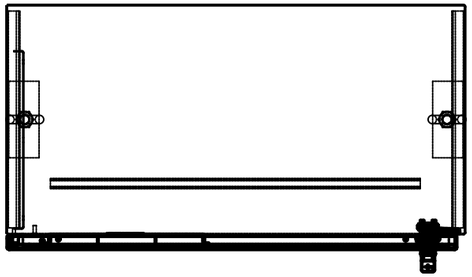
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

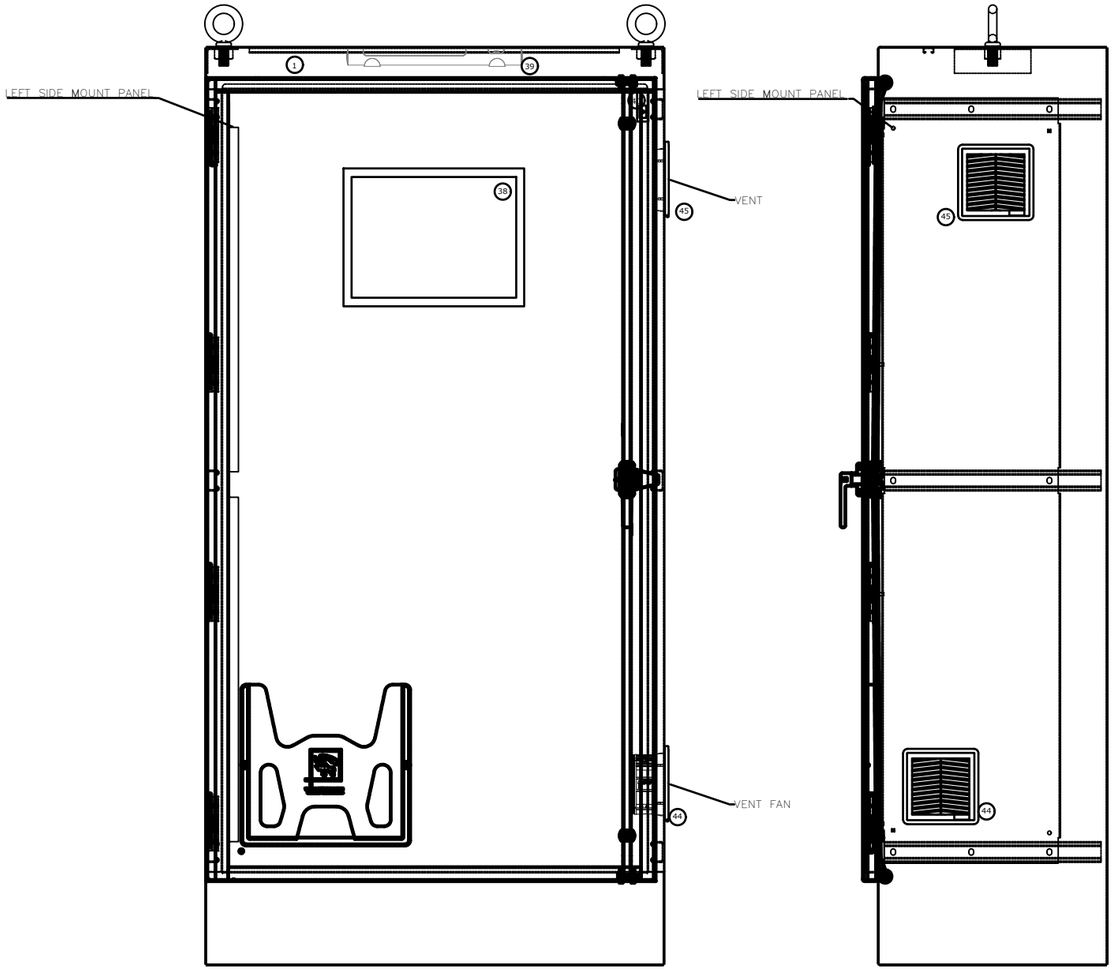
GOLF CLUB TER PUMP STATION
IO LIST

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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ITEM	QTY	BRAND	PART NUMBER	DESCRIPTION
1	1	HOFFMAN	A723618FS	NEMA 12 ENCLOSURE, 72" BY 36" BY 18"
2	1	HOFFMAN	A72P36F1	BACK PANEL, 60" BY 32"
3	1	HOFFMAN	A72SMP14	SIDE PANEL, 60" BY 14"
4	2	CUTLER HAMMER	GBK10	GROUND BAR
5	2	SOLA	SDN-10-24-100C	P/S 10A 24VDC 115/230
6	1	NTRON	108TX	8 PORT INDUSTRIAL ETHERNET SWITCH
7	10	ALLEN BRADLEY	1492-JG4	GROUND TERMINAL
8	1	ALTECH	1DU15L	MAIN CIRCUIT BREAKER, 15A
9	30	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK
10	35	ALLEN BRADLEY	1492-WFB424	FUSED TERMINAL, 24VDC, INDICATOR
11	6	ALLEN BRADLEY	1492-WFB4250	FUSED TERMINAL, 120VAC, INDICATOR
12	0	ALLEN BRADLEY	1492-WFB4	FUSED TERMINAL, NO INDICATOR
13	AR	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER
14	AR	ALLEN BRADLEY	1492-ERL35	J SCREWLESS END STOP
15	1	SIEMENS	6ES7511-1AK02-0AB0	S7-1500 CPU
16	1	SIEMENS	6ES7954-8LC02-0AA0	MEMORY CARD
17	1	SIEMENS	6ES7590-1AC40-0AA0	PLC MOUNTING RAIL
18	2	SIEMENS	6ES7521-1BH00-0AB0	DIGITAL INPUT MODULE, 16 PT, 24VDC
19	1	SIEMENS	6ES7531-7NF00-0AB0	ANALOG INPUT MODULE, 8 PT, ISOLATED, I/V
20	1	SIEMENS	6ES7522-1BH01-0AB0	DIGITAL OUTPUT MODULE, 16 PT, 24VDC
21				
22	3	SIEMENS	6ES7921-5AB20-0AA0	DIGITAL IO MODULE FRONT CONNECTOR
23	1	SIEMENS	6ES7921-5AK20-0AA0	ANALOG IO MODULE FRONT CONNECTOR
24	4	SIEMENS	6ES7924-0AA20-0AA0	DI TERMINATION MODULE 8 point
25	2	SIEMENS	6ES7924-0BD20-0BA0	DO 24VDC RELAY TERMINATION MODULE, LED 8 point
27	4	SIEMENS	6ES7924-0CC20-0AA0	AI TERMINATION MODULE
28	4	SIEMENS	6ES7923-0BB00-0DB0	CABLE, 16 PIN IDC, SHIELD, 1M FOR ANALOG
29	1	PHOENIX	5600462	DUPLEX OUTLET FOR UPS
30	6	SIEMENS	6ES7923-0BB50-0CB0	CABLE, 16 PIN IDC, 1.5M FOR DIGITAL MODULE
31	3	ALLEN-BRADLEY	700-HN-101	RELAY SOCKET
32	1	ALLEN-BRADLEY	700-HA33A1	RELAY, 120VAC COIL, 3 POLE
33	2	ALLEN-BRADLEY	700-HA33A24	RELAY, 24VDC COIL, 3 POLE
34	2	ALLEN-BRADLEY	700-FSM7UU23	TIMING RELAY
35	3	TURCK	IM1-121EX-R	INTRINSIC BARRIER, DISCRETE SIGNAL
36	2	TURCK	IM33-11EX-HI	INTRINSIC BARRIER, ANALOG SIGNAL
37				
38	1	EZ AUTOMATION	EZ3-T10C-E	10" TOUCH SCREEH HMI, 800X600 RES
39	1	STEGO	02541.0-00-0003	PANEL LIGHT, 120VAC LED, MOTION, MAGNETIC
40	1	HOFFMAN	ALFSWD	DOOR SWITCH
41	1	SOLA	SDN2X20RED	24VDC REDUNDANCY MODULE
42	1	SOLA	SDU-10-24B	DC UPS POWER MODULE, 10A 24VDC
43	1	SOLA	SDU-24-BATEM	DC UPS BATTERY MODULE
44	1	SAGINAW	SCE-N12FA44	FILTER FAN, 120VAC
45	1	SAGINAW	SCE-N12FGA44	EXHAUST VENT
46	1	STEGO	01141.9-00	THERMOSTAT
47				
48	1	SHOP SUPPLY	UL LABEL	UL INDUSTRIAL LABEL
49	AR	SHOP SUPPLY	ENGRAVE PLAS NP	PLASTIC NAME PLATES
50	AR	SHOP SUPPLY		35 mm DIN RAIL
51	AR	SHOP SUPPLY		WIRE DUCT
52	AR	SHOP SUPPLY		WIRE DUCT COVER, WHITE

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC3 93 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
PANEL EXTERIOR LAYOUT

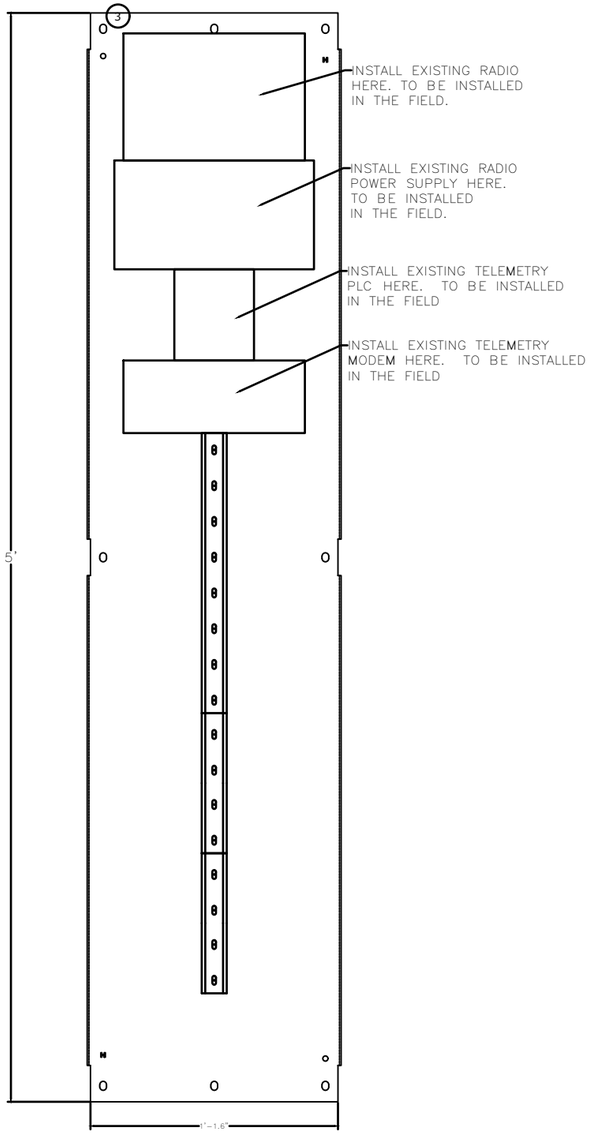
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CLACKAMAS WATER ENVIRONMENT SERVICES

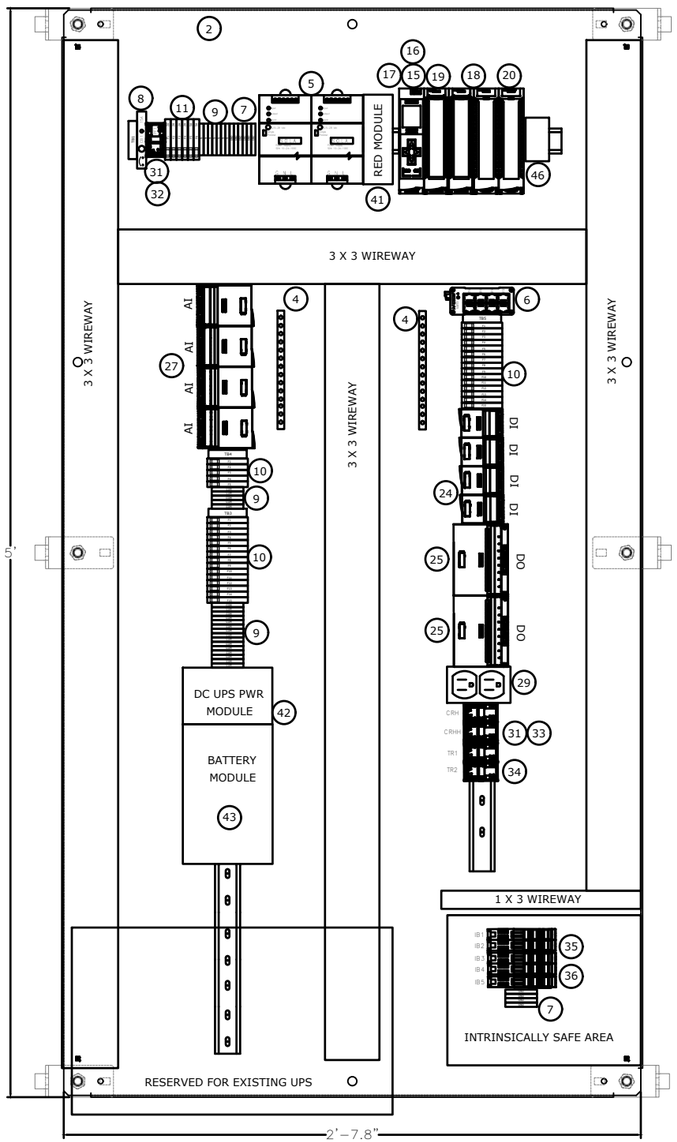
PROJECT: 19-2679 DATE: MAY 2025

C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT-LO-1.dwg 3B-IC3 5/5/2025 10:44 AM PEI 24.0s (LMS Tech)

LEFT SIDE MOUNT PANEL



BACK PANEL



ITEM	QTY	BRAND	PART NUMBER	DESCRIPTION
1	1	HOFFMAN	A723618FS	NEMA 12 ENCLOSURE, 72" BY 36" BY 18"
2	1	HOFFMAN	A72P36F1	BACK PANEL, 60" BY 32"
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7	10	ALLEN BRADLEY	1492-JG4	GROUND TERMINAL
8	1	ALTECH	1DU15L	MAIN CIRCUIT BREAKER, 15A
9	30	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK
10	35	ALLEN BRADLEY	1492-WFB424	FUSED TERMINAL, 24VDC, INDICATOR
11	6	ALLEN BRADLEY	1492-WFB4250	FUSED TERMINAL, 120VAC, INDICATOR
12	0	ALLEN BRADLEY	1492-WFB4	FUSED TERMINAL, NO INDICATOR
13	AR	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER
14	AR	ALLEN BRADLEY	1492-ERL35	J SCREWLESS END STOP
15	1	SIEMENS	6ES7511-1AK02-0AB0	S7-1500 CPU
16	1	SIEMENS	6ES7954-8LC02-0AA0	MEMORY CARD
17	1	SIEMENS	6ES7590-1AC40-0AA0	PLC MOUNTING RAIL
18	2	SIEMENS	6ES7521-1BH00-0AB0	DIGITAL INPUT MODULE, 16 PT, 24VDC
19	1	SIEMENS	6ES7531-7NF00-0AB0	ANALOG INPUT MODULE, 8 PT, ISOLATED, I/V
20	1	SIEMENS	6ES7522-1BH01-0AB0	DIGITAL OUTPUT MODULE, 16 PT, 24VDC
21				
22	3	SIEMENS	6ES7921-5AB20-0AA0	DIGITAL IO MODULE FRONT CONNECTOR
23	1	SIEMENS	6ES7921-5AK20-0AA0	ANALOG IO MODULE FRONT CONNECTOR
24	4	SIEMENS	6ES7924-0AA20-0AA0	DI TERMINATION MODULE 8 point
25	2	SIEMENS	6ES7924-0BD20-0BA0	DO 24VDC RELAY TERMINATION MODULE, LED 8 point
27	4	SIEMENS	6ES7924-0CC20-0AA0	AI TERMINATION MODULE
28	4	SIEMENS	6ES7923-0BB00-0DB0	CABLE, 16 PIN IDC, SHIELD, 1M FOR ANALOG
29	1	PHOENIX	5600462	DUPLEX OUTLET FOR UPS
30	6	SIEMENS	6ES7923-0BB50-0CB0	CABLE, 16 PIN IDC, 1.5M FOR DIGITAL MODULE
31	3	ALLEN-BRADLEY	700-HN-101	RELAY SOCKET
32	1	ALLEN-BRADLEY	700-HA33A1	RELAY, 120VAC COIL, 3 POLE
33	2	ALLEN-BRADLEY	700-HA33A24	RELAY, 24VDC COIL, 3 POLE
34	2	ALLEN-BRADLEY	700-FSM7UU23	TIMING RELAY
35	3	TURCK	IM1-121EX-R	INTRINSIC BARRIER, DISCRETE SIGNAL
36	2	TURCK	IM33-11EX-HI	INTRINSIC BARRIER, ANALOG SIGNAL
37				
38	1	EZ AUTOMATION	EZ3-T10C-E	10" TOUCH SCREEH HMI, 800X600 RES
39	1	STEGO	02541.0-00-0003	PANEL LIGHT, 120VAC LED, MOTION, MAGNETIC
40	1	HOFFMAN	ALFSWD	DOOR SWITCH
41	1	SOLA	SDN2X20RED	24VDC REDUNDANCY MODULE
42	1	SOLA	SDU-10-24B	DC UPS POWER MODULE, 10A 24VDC
43	1	SOLA	SDU-24-BATEM	DC UPS BATTERY MODULE
44	1	SAGINAW	SCE-N12FA44	FILTER FAN, 120VAC
45	1	SAGINAW	SCE-N12FGA44	EXHAUST VENT
46	1	STEGO	01141.9-00	THERMOSTAT
47				
48	1	SHOP SUPPLY	UL LABEL	UL INDUSTRIAL LABEL
49	AR	SHOP SUPPLY	ENGRAVE PLAS NP	PLASTIC NAME PLATES
50	AR	SHOP SUPPLY		35 mm DIN RAIL
51	AR	SHOP SUPPLY		WIRE DUCT
52	AR	SHOP SUPPLY		WIRE DUCT COVER, WHITE

SHEET NOTES:

1. INSTALL BARRIER TO SEPARATE INTRINSICALLY SAFE AREA FROM OTHER PANEL COMPONENTS.

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC4 94 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT: HORIZ:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
PANEL INTERIOR LAYOUT

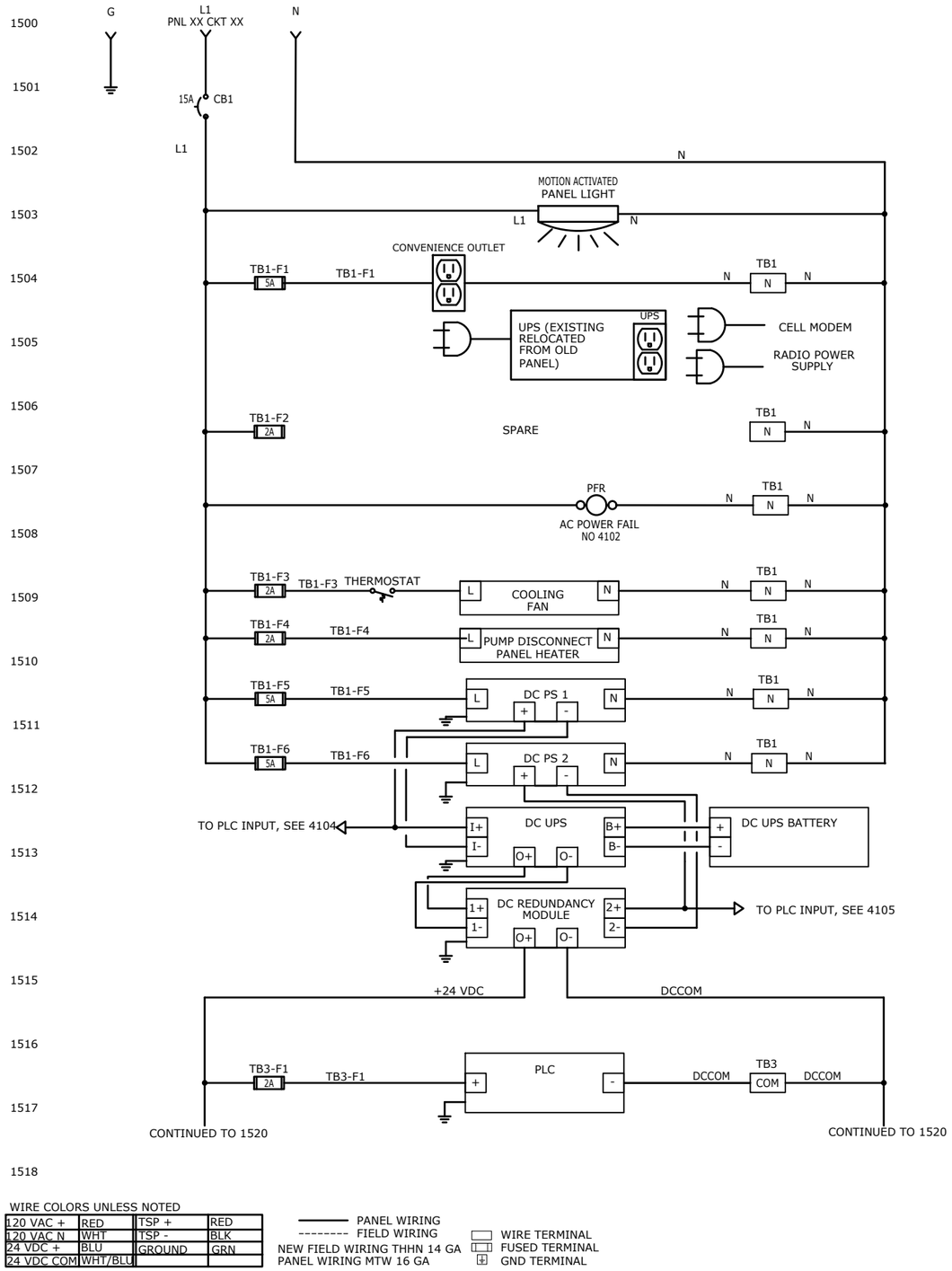
consor

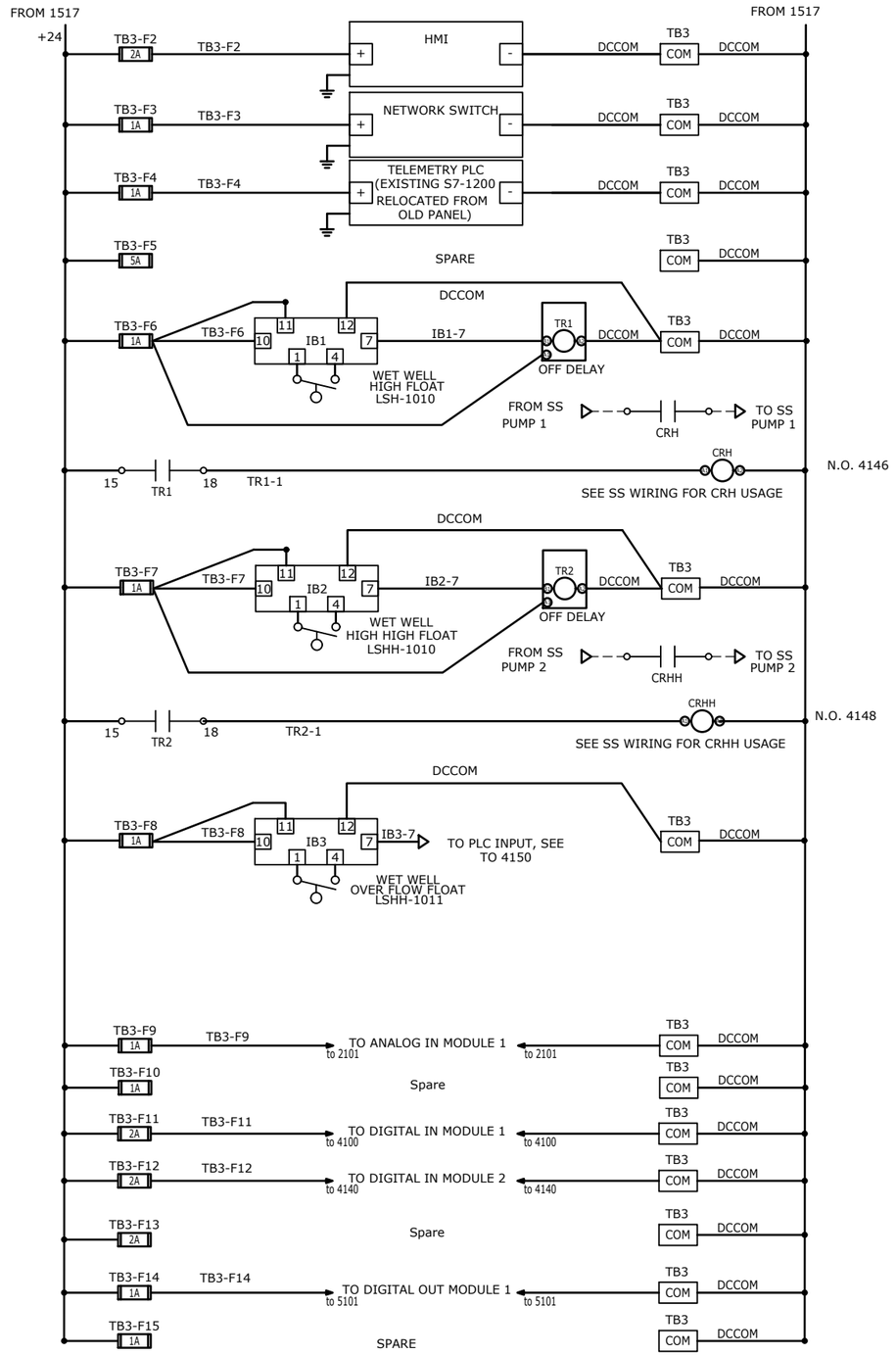
DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT-LO-2.dwg 3B-IC4 5/5/2025 10:44 AM PEI 24.0s (LMS Tech)





WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC5 95 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JAMES C. HAWPE — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
POWER DISTRIBUTION

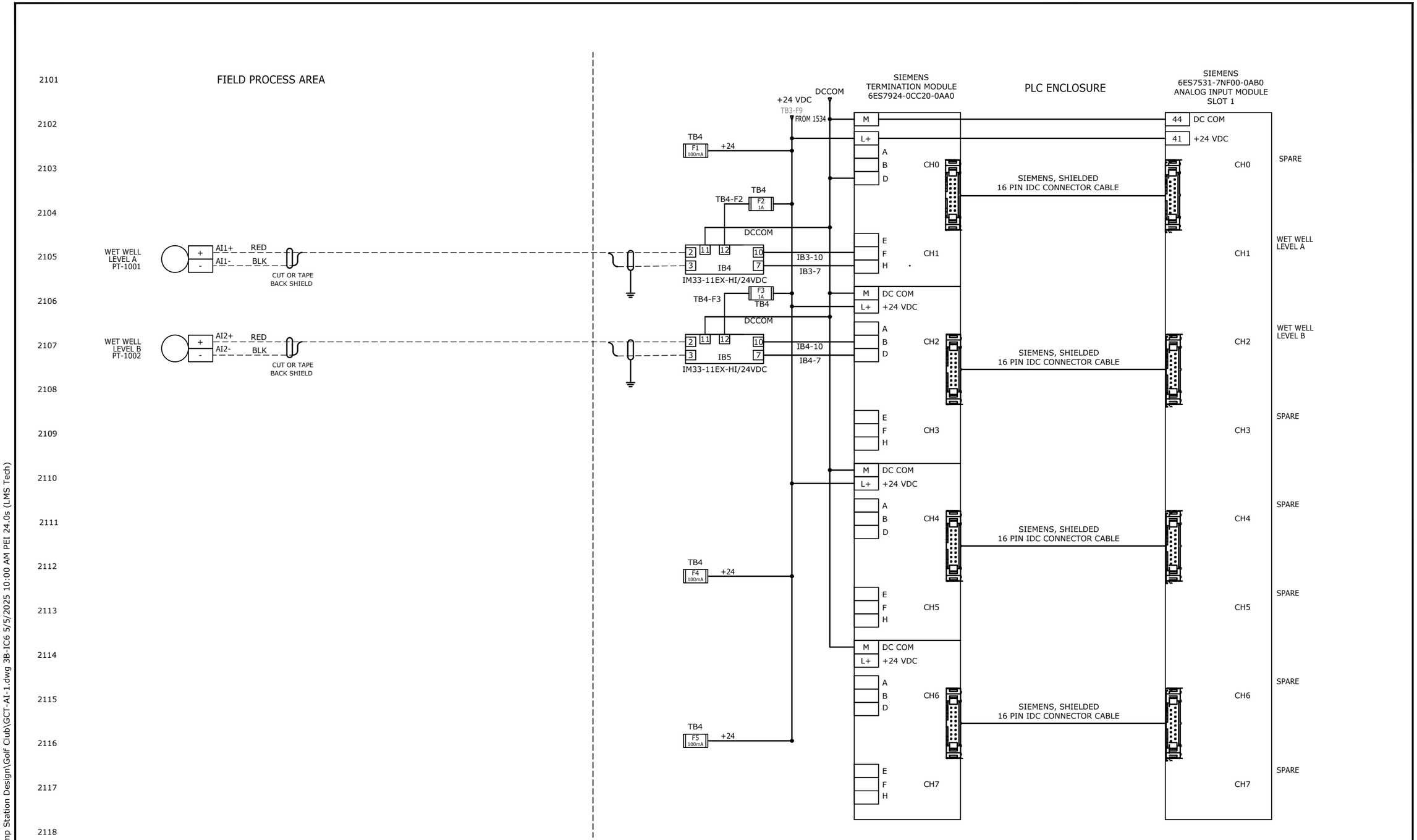
consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT-AI-1.dwg 3B-IC6 5/5/2025 10:00 AM PEI 24.0s (LMS Tech)

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

SHEET 3B-IC6 96 of 184

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — DEC. 17, 2024 — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
ANALOG INPUT

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

DATE: MAY 2025
19-2679
PROJECT:

FIELD PROCESS AREA

4100
4101
4102
4103
4104
4105
4106
4107
4108
4109
4110
4111
4112
4113
4114
4115
4116
4117

POWER FAIL
PFR

ATS IN GENERATOR POSITION
YI-2010

ATS IN UTILTIY POSITION
YI-2010A

GENERATOR RUNNING
YI-2011

GENERATOR FAULT
YI-2012

+24 VDC
TB3-F11
FROM 1535

DCCOM

PFR
1508
DI1-0

FROM PS1, SEE 1513

FROM PS2, SEE 1514

TB5-F1
1A
DI1-3

TB5-F1
1A
DI1-4

TB5-F2
1A
DI1-5

TB5-F2
1A
DI1-6

TB5-F3
1A

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

M			
L+			
0	IN- 0	CH0	POWER FAIL STATUS
1	IN- 1	CH1	POWER SUPPLY 1 STATUS
2	IN- 2	CH2	POWER SUPPLY 2 STATUS
3	IN- 3	CH3	ATS IN GEN POSITION
4	IN- 4	CH4	ATS IN UTILITY POSITION
5	IN- 5	CH5	GENERATOR RUNNING
6	IN- 6	CH6	GENERATOR FAULT
7	IN- 7	CH7	SPARE

SIEMENS
16 PIN IDC CONNECTOR CABLE

SIEMENS
6ES7522-1BH01-0AB0
DIGITAL INPUT MODULE
SLOT 2

20	DC COM		
19	+24 VDC		
CH0		0	POWER FAIL STATUS
CH1		1	POWER SUPPLY 1 STATUS
CH2		2	POWER SUPPLY 2 STATUS
CH3		3	ATS IN GEN POSITION
CH4		4	ATS IN UTILITY POSITION
CH5		5	GENERATOR RUNNING
CH6		6	GENERATOR FAULT
CH7		7	SPARE

CONTINUED ON NEXT SHEET

CONTINUED ON NEXT SHEET

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY
DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC7 97 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

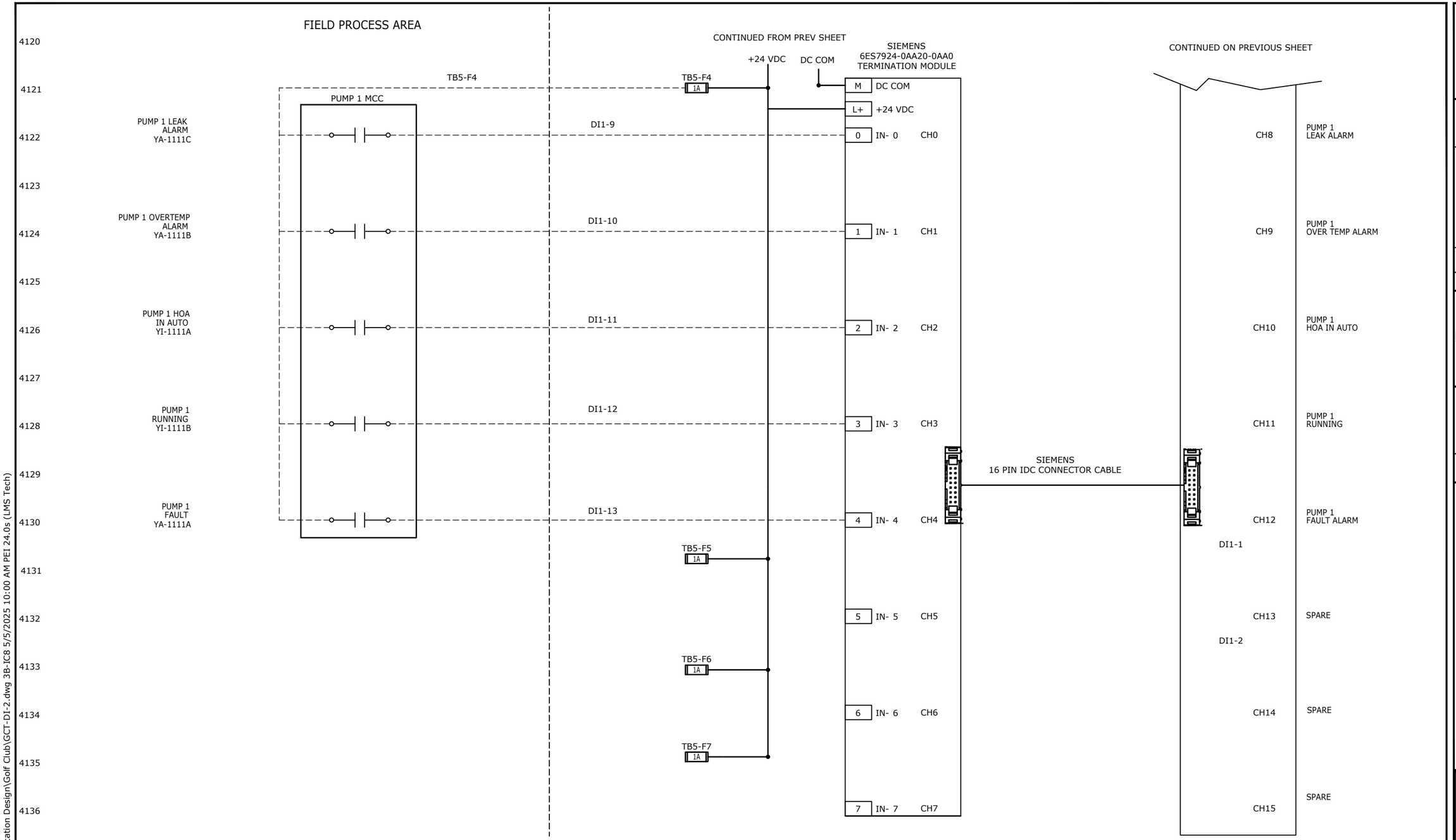
GOLF CLUB TER PUMP STATION
DIGITAL INPUT - 1

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT-DI-1.dwg 3B-IC7 5/5/2025 10:00 AM PEI 24.0s (LMS Tech)



C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT-DI-2.dwg 3B-IC8 5/5/2025 10:00 AM PEI 24.0s (LMS Tech)

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC8 98 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT: HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
DIGITAL INPUT - 2

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

DATE: MAY 2025
PROJECT: 19-2679

FIELD PROCESS AREA

4140
4141
4142
4143
4144
4145
4146
4147
4148
4149
4150
4151
4152
4153
4154
4155
4156
4157

SMOKE ELECT RM.
YS-1001

BUILDING INTRUSION
YS-1002

WET WELL
HIGH LEVEL FLOAT
LSH-1010

WET WELL
HIGH HIGH LEVEL FLOAT
LSHH-1010

WET WELL
OVER FLOW LEVEL FLOAT
LSHH-1011

TB5-F8 — 1A — +24 VDC (TB3-F12 FROM 1536) — DCCOM

TB5-F8

DI2-0

TB5-F9 — 1A

DI2-1

CRH — 1526 — DI2-2

CRHH — 1528 — DI2-3

IB3-7 — IB3 — 1533 — DI2-4

TB5-F10 — 1A

TB5-F11 — 1A

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

M		
L+		
0	IN- 0	CH0
1	IN- 1	CH1
2	IN- 2	CH2
3	IN- 3	CH3
4	IN- 4	CH4
5	IN- 5	CH5
6	IN- 6	CH6
7	IN- 7	CH7

SIEMENS
16 PIN IDC CONNECTOR CABLE

SIEMENS
6ES7522-1BH01-0AB0
DIGITAL INPUT MODULE
SLOT 3

20	DC COM		
19	+24 VDC		
		CH0	SMOKE ALARM ELECT ROOM
		CH1	BUILDING INTRUSION
		CH2	WET WELL HIGH FLOAT
		CH3	WET WELL HIGH HIGH FLOAT
		CH4	WET WELL OVER FLOW FLOAT
		CH5	SPARE
		CH6	SPARE
		CH7	SPARE

CONTINUED ON NEXT SHEET

CONTINUED ON NEXT SHEET

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

PANEL WIRING
FIELD WIRING
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC9 99 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBER — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
DIGITAL INPUT - 3

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

DATE: MAY 2025
PROJECT: 19-2679

C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT-DI-3.dwg 3B-IC9 5/5/2025 10:04 AM PEI 24.0s (LMS Tech)

FIELD PROCESS AREA

CONTINUED FROM PREV SHEET

CONTINUED ON PREVIOUS SHEET

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

+24 VDC

DC COM

PUMP 2 MCC

TB5-F12

TB5-F12
1A

4160						
4161				M	DC COM	
				L+	+24 VDC	
4162	PUMP 2 LEAK ALARM YA-1111C	DI2-8		0	IN- 0	CH0
4163						
4164	PUMP 2 OVERTEMP ALARM YA-1111B	DI2-9		1	IN- 1	CH1
4165						
4166	PUMP 2 HOA IN AUTO YI-1111A	DI2-10		2	IN- 2	CH2
4167						
4168	PUMP 2 RUNNING YI-1111B	DI2-11		3	IN- 3	CH3
4169						
4170	PUMP 2 FAULT YA-1111A	DI2-12		4	IN- 4	CH4
4171			TB5-F13 1A			
4172				5	IN- 5	CH5
4173			TB5-F14 1A			
4174				6	IN- 6	CH6
4175			TB5-F15 1A			
4176				7	IN- 7	CH7
4177						

SIEMENS
16 PIN IDC CONNECTOR CABLE

CH8	PUMP 2 LEAK ALARM	
CH9	PUMP 2 OVER TEMP ALARM	
CH10	PUMP 2 HOA IN AUTO	
CH11	PUMP 2 RUNNING	
CH12	PUMP 2 FAULT ALARM	
CH13	SPARE	
CH14	SPARE	
CH15	SPARE	

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC10 100 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
JAMES C. HAPPE
17, 2014
CARL M. SIMS
EXPIRES: 06/30/2026

SCALE
VERT:
HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

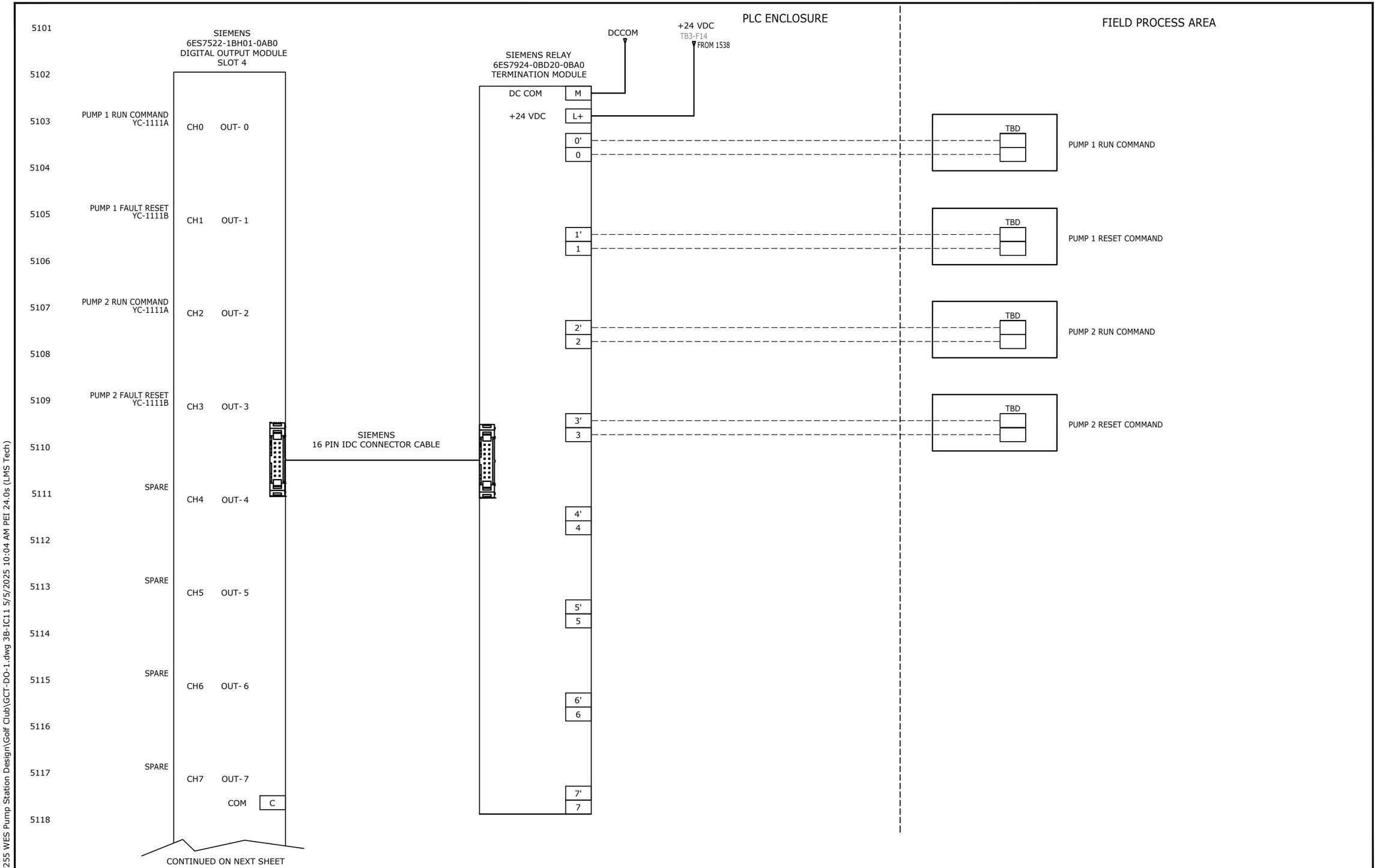
GOLF CLUB TER PUMP STATION
DIGITAL INPUT - 4

consor

PROJECT: 19-2679
DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT-DI-4.dwg 3B-IC10 5/5/2025 10:04 AM PEI 24.0s (LMS Tech)



C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT-DO-1.dwg 3B-IC11 5/5/2025 10:04 AM PEI 24.0s (LMS Tech)

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC11
101 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 17, 2024
CARL M. SIMPSON
EXPIRES: 06/30/2026

SCALE
VERT:
HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

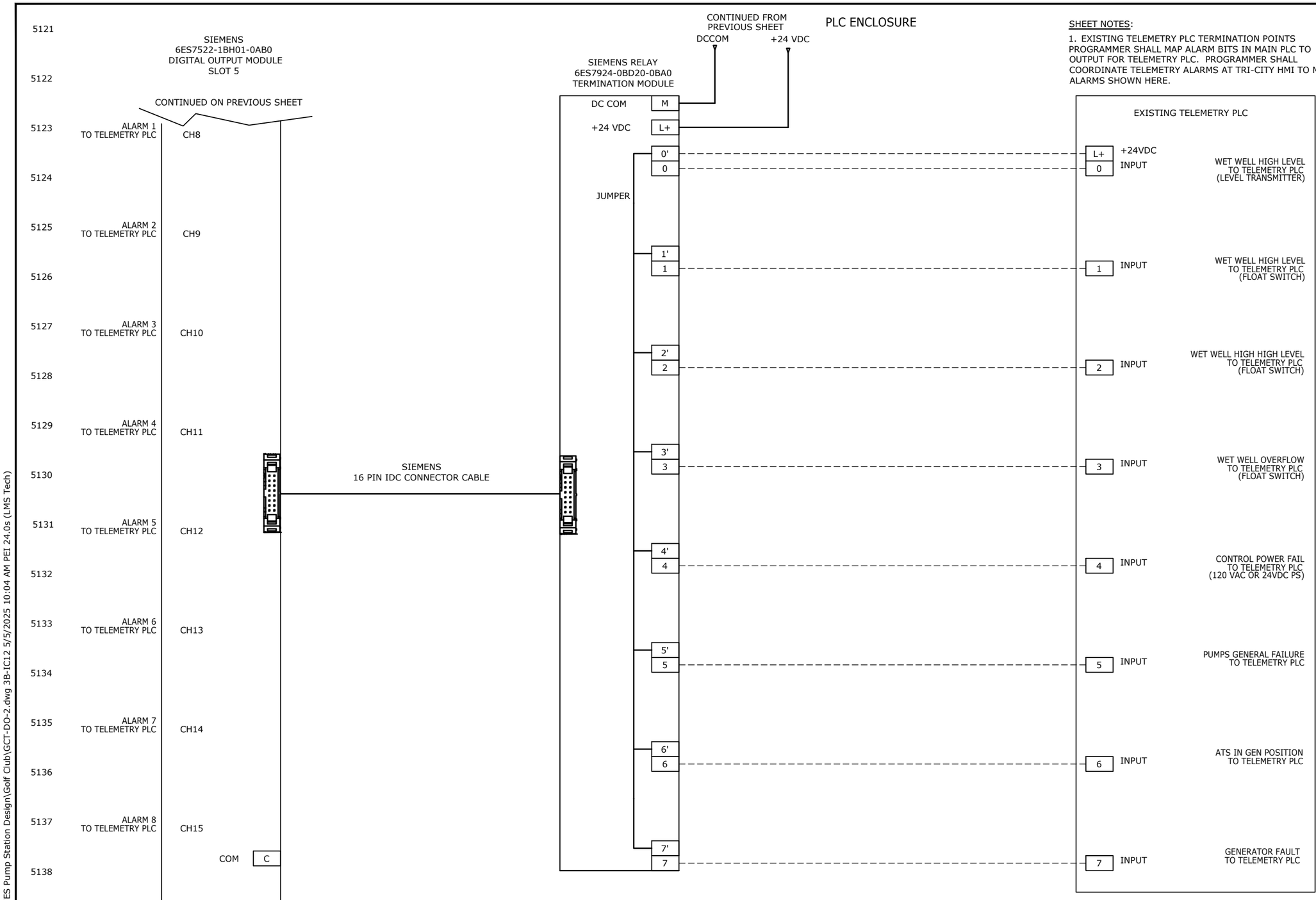
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
DIGITAL OUTPUT - 1

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025



SHEET NOTES:

1. EXISTING TELEMETRY PLC TERMINATION POINTS PROGRAMMER SHALL MAP ALARM BITS IN MAIN PLC TO OUTPUT FOR TELEMETRY PLC. PROGRAMMER SHALL COORDINATE TELEMETRY ALARMS AT TRI-CITY HMI TO MATCH ALARMS SHOWN HERE.

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC12
102 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SWAPE — DEC. 17, 2024 — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
DIGITAL OUTPUT - 2

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

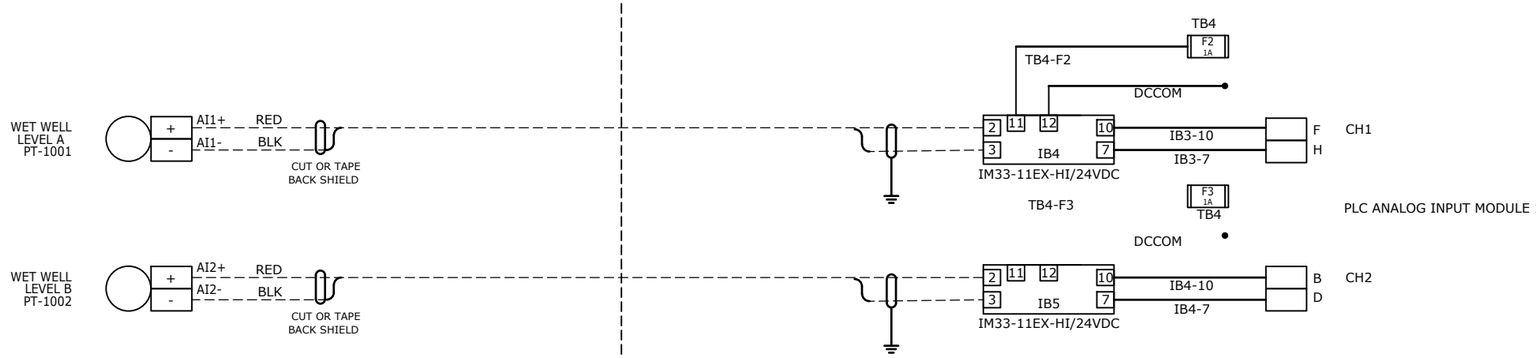
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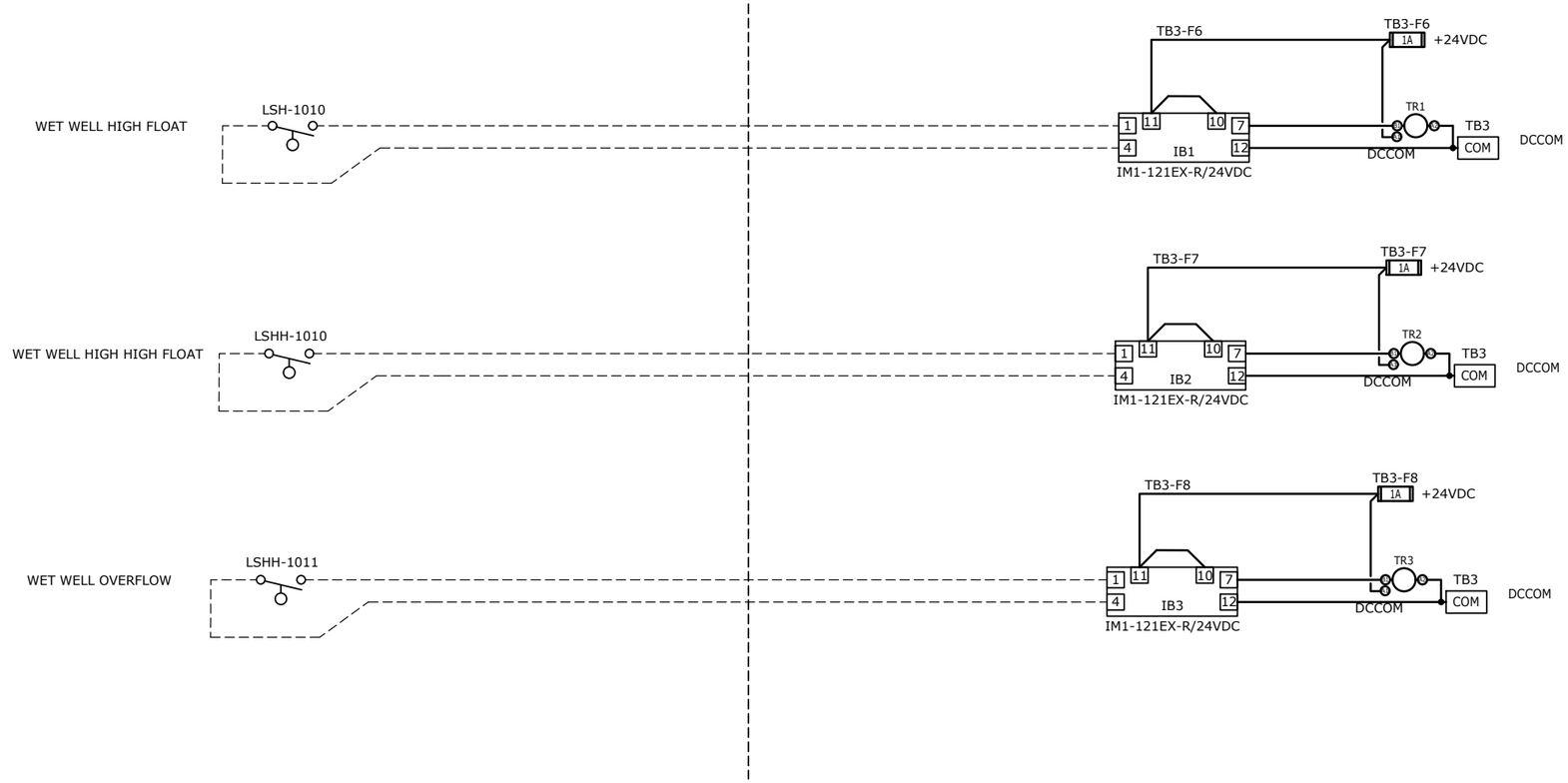
HAZARDOUS AREA
CLASS 1, DIVISION 1, GROUP D

SAFE AREA

SHEET NOTES:

1. INTRINSICALLY SAFE DETAIL APPLIES TO ANALOG INPUT ON SHEET AI-1. APPLIES TO FLOAT CONTROLS ON SHEET PWR. CERTIFICATION: TURCK IECEx TUN 06.0007X





WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC13 103 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — DEC. 17, 2024 — KARL M. CARLSON — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
INTRINSIC SAFETY

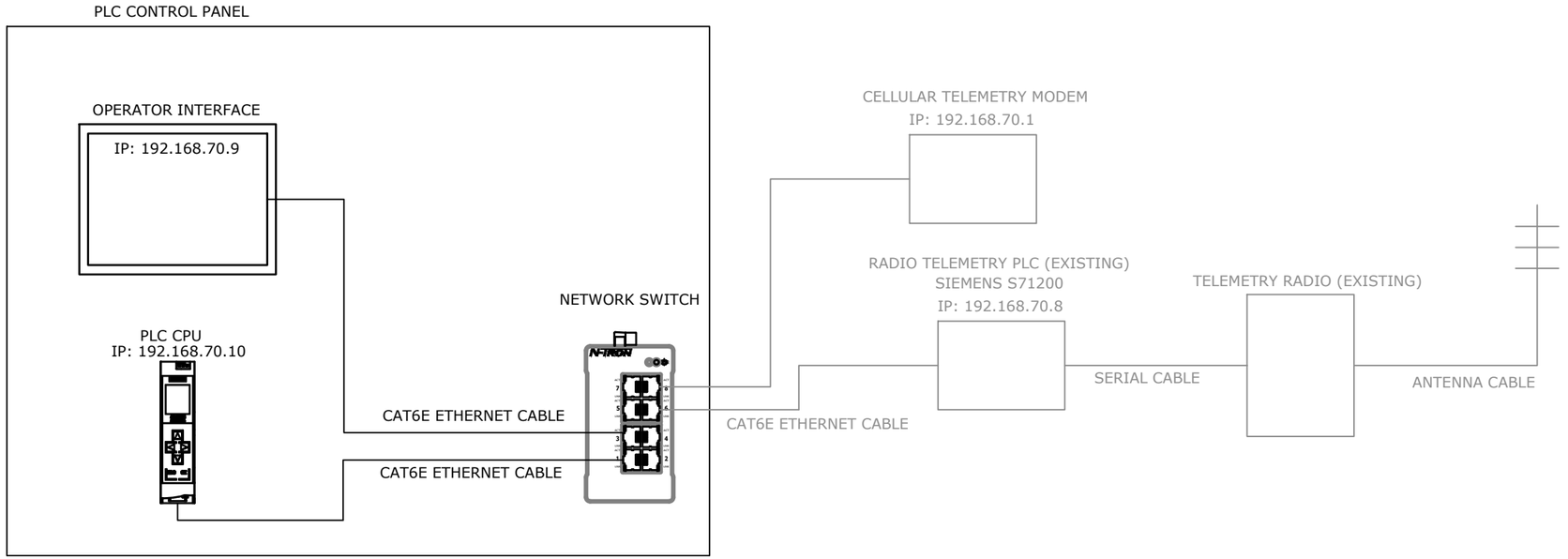
consor

DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679

C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT-IS.dwg 3B-IC13 5/5/2025 10:03 AM PEI 24.0s (LMS Tech)



C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT NET.dwg 3B-IC14 5/5/2025 10:03 AM PEI 24.0s (LMS Tech)

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC14 104 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JAMES C. HAYHURST — DEC. 17, 2024 — CARL M. SIEBEN

EXPIRES: 06/30/2026

SCALE VERT.: HORIZ:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
NETWORK DETAIL

CLACKAMAS WATER ENVIRONMENT SERVICES

consor

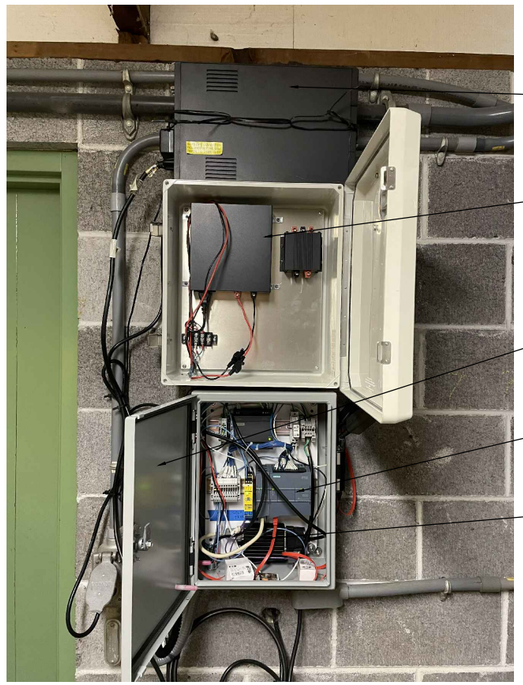
PROJECT: 19-2679 DATE: MAY 2025

SHEET NOTES:

1. PULL BACK AND RE-ROUTE EXISTING ANTENNA WIRES FOR CELLULAR MODEM AND RADIO INTO NEW CONTROL PANEL.



EXISTING CONTROL PANEL AND BUBBLER DEMOLITION 1/-



EXISTING TELEMETRY AND RADIO POWER PANEL DEMOLITION DETAIL 2/-



EXISTING CELLULAR MODEM DEMOLITION 3/-

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3B-IC15

105 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. WISEMAN — EXPIRES: 06/30/2026

SCALE VERT: HORIZ: NOTICE

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

GOLF CLUB TER PUMP STATION
INSTALL AND DEMOLITION DETAIL

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

DATE: MAY 2025

PROJECT: 19-2679

C:\AutoCAD Projects\V255 WES Pump Station Design\Golf Club\GCT DEMO.dwg 3B-IC15 5/5/2025 10:03 AM PEI 24.0s (LMS Tech)

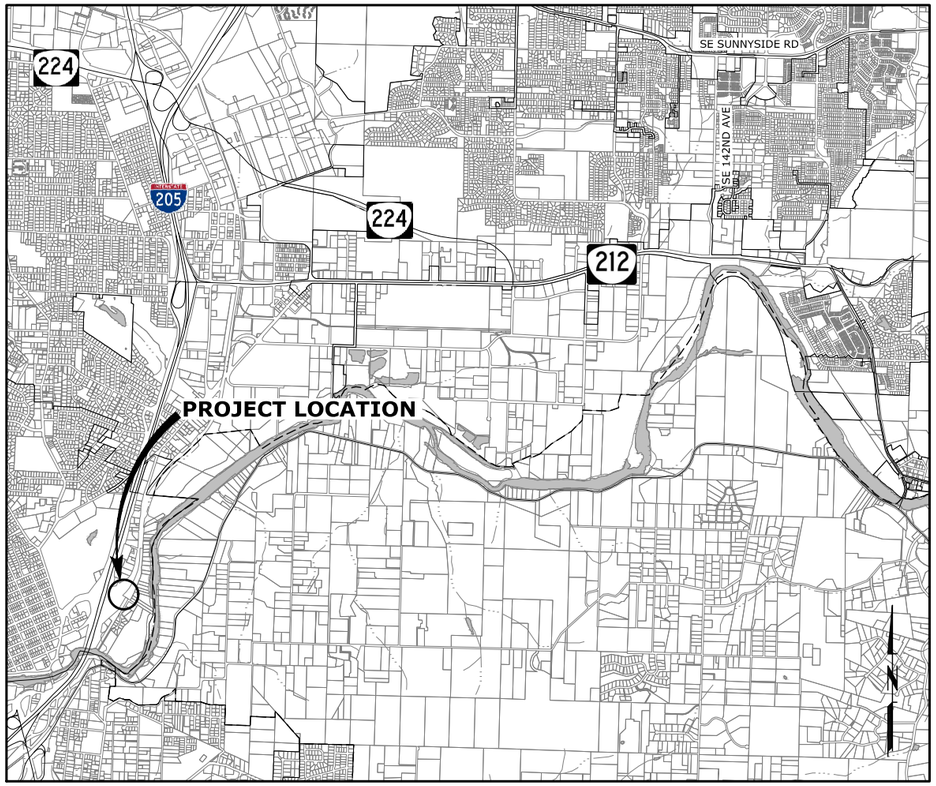
CLACKAMAS WATER ENVIRONMENT SERVICES

PUMP STATION REHABILITATION AND UPGRADES PROJECT

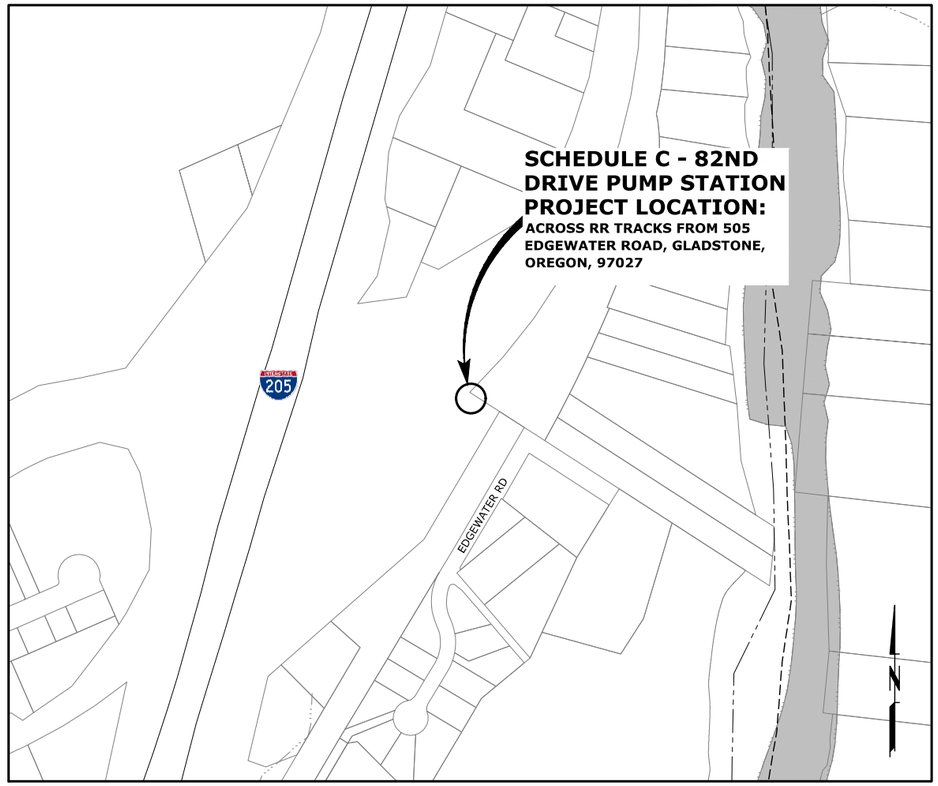
GROUP 3

SCHEDULE C - 82ND DRIVE PUMP STATION

AUGUST 2024



VICINITY MAP
SCALE: 1"=2,000'



LOCATION MAP
SCALE: 1"=200'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: JCC
CHECKED: EPK
APPROVED: NSL

SHEET 3C-G1 106 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas S. Lafrenz
RENEWS 12-31-26

SCALE VERT.: AS SHOWN HORIZ.: AS SHOWN
NOTICE 0 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DRIVE PUMP STATION
COVER SHEET, LOCATION & VICINITY MAP

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

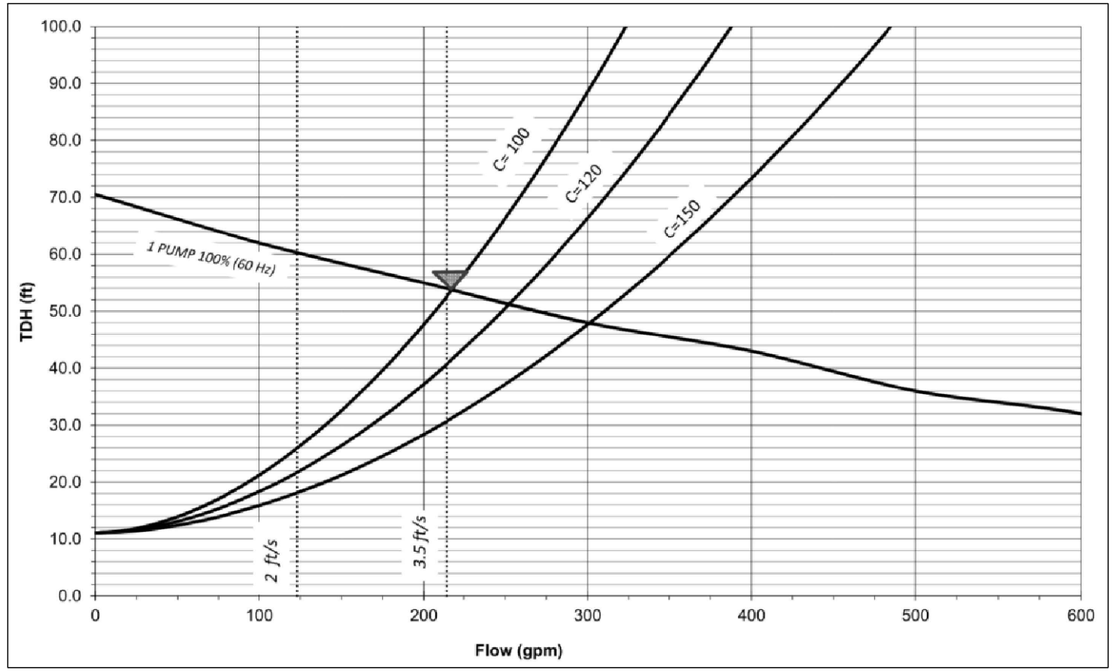
PROJECT: 19-2679 DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH C-G.dwg 3C-G1 9/9/2024 10:19 AM JEFFRY.ORLANDO 24.1s (LMS Tech)

82ND DRIVE PUMP STATION AND FORCE MAIN DESIGN DATA TABLE

PUMP STATION	
LOCATION	ACROSS RR TRACKS FROM 505 EDGEWATER LANE, GLADSTONE, OREGON, 97027
TYPE	DUPLEX SUBMERSIBLE SEWAGE PUMP STATION WITH CONSTANT SPEED PUMPS
RATED CAPACITY (PER PUMP)	MINIMUM 214 GPM AT 52 FT TDH
FIRM CAPACITY OF PUMP STATION	214 GPM AT 52 FT TDH
MOTOR HORSEPOWER, HP	8.5 HP
PUMP STARTS AT INFLOW = 50% OF THE PUMP CAPACITY	5.0 PER PUMP PER HOUR
WET WELL OPERATIONAL VOLUME	423 GALLONS (PUMPS OFF TO LEAD PUMP ON)
LEVEL CONTROL TYPE	SUBMERSIBLE LEVEL TRANSDUCER (PRIMARY), HIGH LEVEL FLOAT W/ TIMER SHUT-OFF (BACKUP)
ALARM TELEMETRY TYPE	RADIO MODEM W/ PLC
STANDBY POWER TYPE	30 KW PERMANENT DIESEL STANDBY GENERATOR WITH AUTOMATIC TRANSFER SWITCH
FUEL TANK CAPACITY	74 GALLONS, 24 HOUR CAPACITY
OVERFLOW POINT	STATION WET WELL
OVERFLOW ELEVATION	50.9 FEET
100-YEAR & 500-YEAR FLOOD ELEVATIONS	N/A
EPA RELIABILITY CLASS	1
FORCE MAIN	
TYPE AND LENGTH	1566 FEET OF 5" HDPE FORCE MAIN
PROFILE DESCRIPTION	CONTINUOUSLY ASCENDING
AIR RELEASE VALVES	NONE
AVERAGE FORCE MAIN DETENTION TIME	30 MINUTES
DISCHARGE LOCATION	SSMH 1517 ON E ARLINGTON STREET IN SAFEWAY PARKING LOT
SULFIDE CONTROL SYSTEM	NONE

82ND DRIVE PUMP STATION SYSTEM HEAD AND PUMP CURVES



g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabiltation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH C-G.dwg 3C-G2 9/9/2024 10:19 AM JEFFRY.ORLANDO 24.1s (LMS Tech)

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: MBE
CHECKED: EPK
APPROVED: NSL

SHEET 3C-G2 107 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas S. Laferriz
RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

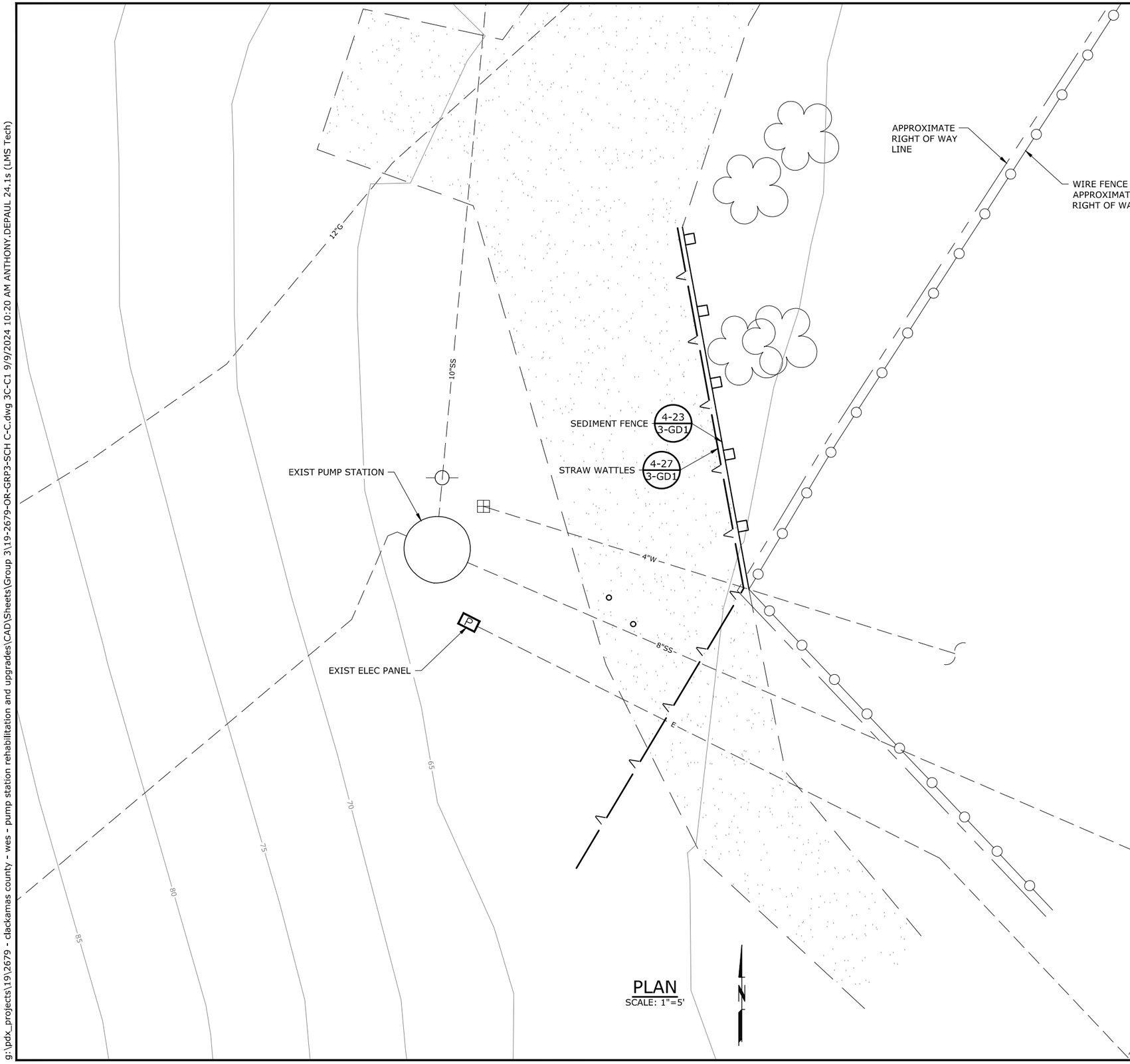
82ND DRIVE PUMP STATION
DESIGN DATA TABLE AND SYSTEM CURVE

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH C-C.dwg 3C-C1 9/9/2024 10:20 AM ANTHONY.DEPAUL 24.1s (LMS Tech)



PLAN
SCALE: 1"=5'

SHEET NOTES:

1. ALL WORK SHALL BE PERFORMED WITHIN ODOT RIGHT OF WAY.

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3C-C1

108 of 184

OREGON PROFESSIONAL ENGINEER 98172 Nicholas S. Lafrenz Date: RENEWS 12-31-26

OREGON LICENSED LANDSCAPE ARCHITECT 000000 Nicholas S. Lafrenz Date: RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

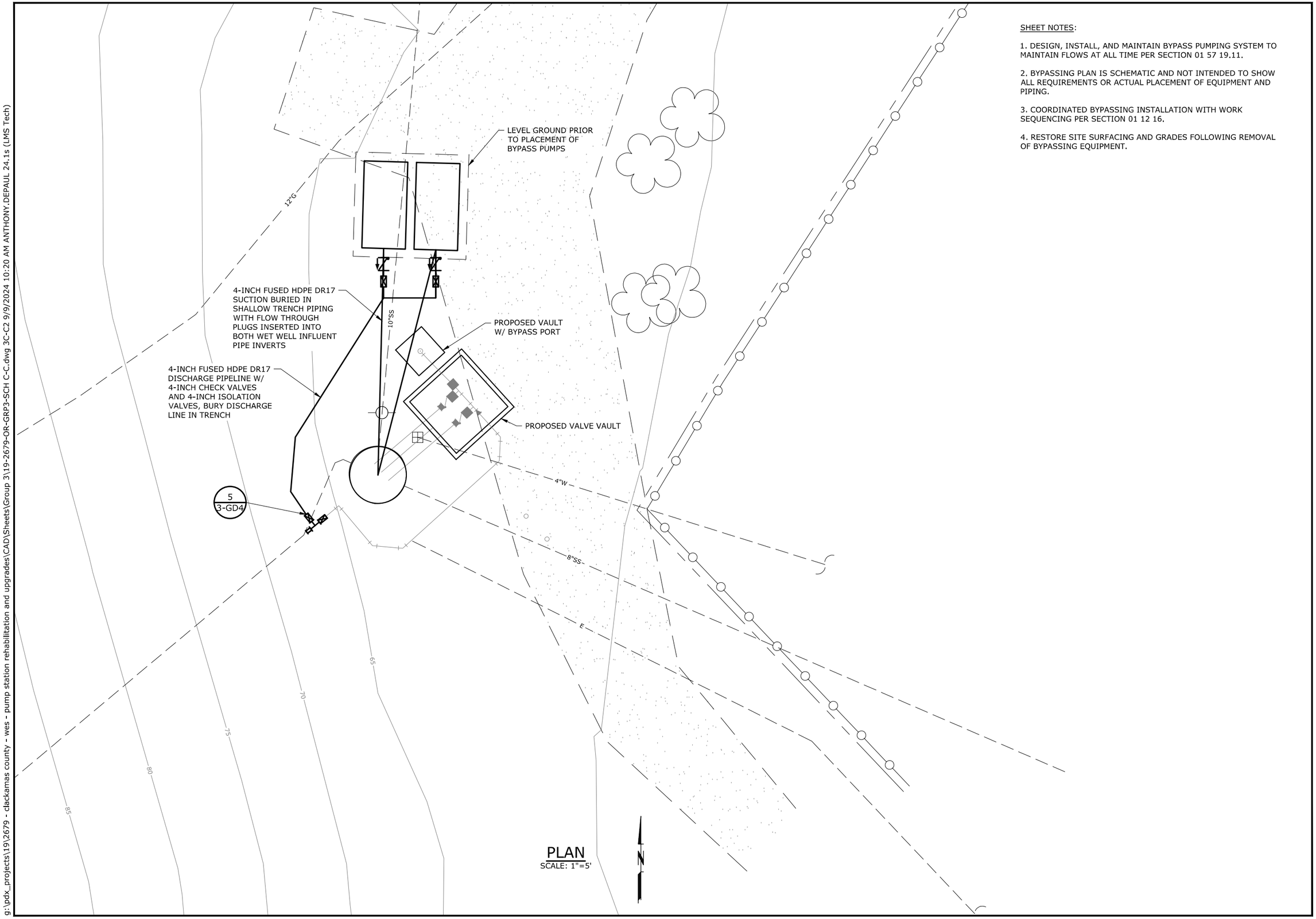
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 – SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
SITE PREPARATION
AND EROSION CONTROL

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025



PLAN
SCALE: 1"=5'

SHEET NOTES:

1. DESIGN, INSTALL, AND MAINTAIN BYPASS PUMPING SYSTEM TO MAINTAIN FLOWS AT ALL TIME PER SECTION 01 57 19.11.

2. BYPASSING PLAN IS SCHEMATIC AND NOT INTENDED TO SHOW ALL REQUIREMENTS OR ACTUAL PLACEMENT OF EQUIPMENT AND PIPING.

3. COORDINATED BYPASSING INSTALLATION WITH WORK SEQUENCING PER SECTION 01 12 16.

4. RESTORE SITE SURFACING AND GRADES FOLLOWING REMOVAL OF BYPASSING EQUIPMENT.

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3C-C2
109 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
98172
Nicholas S. Lafrenz
Date:
RENEWS 12-31-26

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 10, 2001
DAVID K. HOLLOWAY
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0
1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 – SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
BYPASS PUMPING PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH C-C.dwg 3C-C2 9/9/2024 10:20 AM ANTHONY.DEPAUL 24.1s (LMS Tech)

REMOVE TREES, TYP OF 4

REMOVE AND DISPOSE OF EXIST ANTENNA POLE, ANTENNA EQUIPMENT TO BE REUSED

CONTRACTOR TO REMOVE VALVE AND PIPE AS NEEDED AND INSTALL CAP ONTO ABANDONED WATER LINE, COORDINATE WITH CITY OF GLADSTONE

REMOVE AND DISPOSE OF EXIST WET WELL FIBERGLASS ENCLOSURE, PUMPS AND PIPING, SEE 3C-M SHTS FOR PROPOSED CONC WET WELL WALL RETROFIT

REMOVE AND DISPOSE OF EXIST CONTROL AND POWER PANELS, SEE 3C-E SHTS

12"G

10"SS

4"W

8"SS

E

65

70

75

80

85

PLAN
SCALE: 1"=5'

N

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET
3C-C3
110 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 09, 1999
Nicholas S. Lafrenz
Date:
RENEWS 12-31-26

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 09, 1999
Nicholas S. Lafrenz
Date:
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

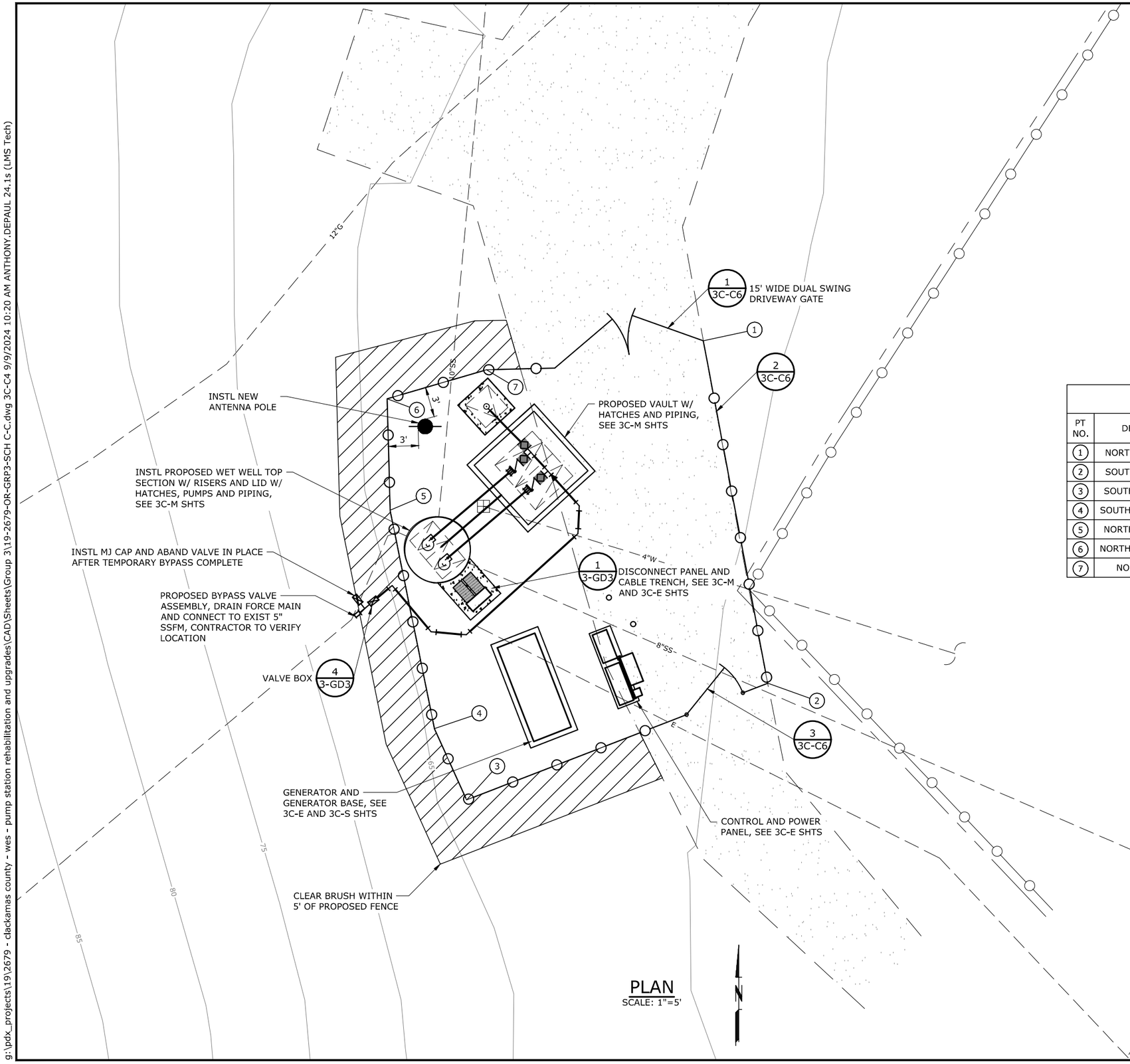
82ND DR PUMP STATION
SITE DEMOLITION PLAN

consor

CLACKAMAS
WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH C-C.dwg 3C-C3 9/9/2024 10:20 AM ANTHONY.DEPAUL 24.1s (LMS Tech)



PLAN
SCALE: 1"=5'

FENCE POINT TABLE			
PT NO.	DESCRIPTION	NORTHING	EASTING
1	NORTHEAST CORNER	N633195.67	E7668531.54
2	SOUTHEAST CORNER	N633161.65	E7668537.94
3	SOUTHWEST CORNER	N633150.06	E7668508.03
4	SOUTHWEST CORNER 2	N633157.13	E7668504.83
5	NORTHWEST CORNER	N633178.83	E7668500.43
6	NORTHWEST CORNER 2	N633189.91	E7668500.14
7	NORTH CORNER	N633192.79	E7668509.99

NO. | DATE | REVISION | BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3C-C4

111 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas A. Lafrenz
Date:
OREGON
RENEWS 12-31-26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
SITE PLAN

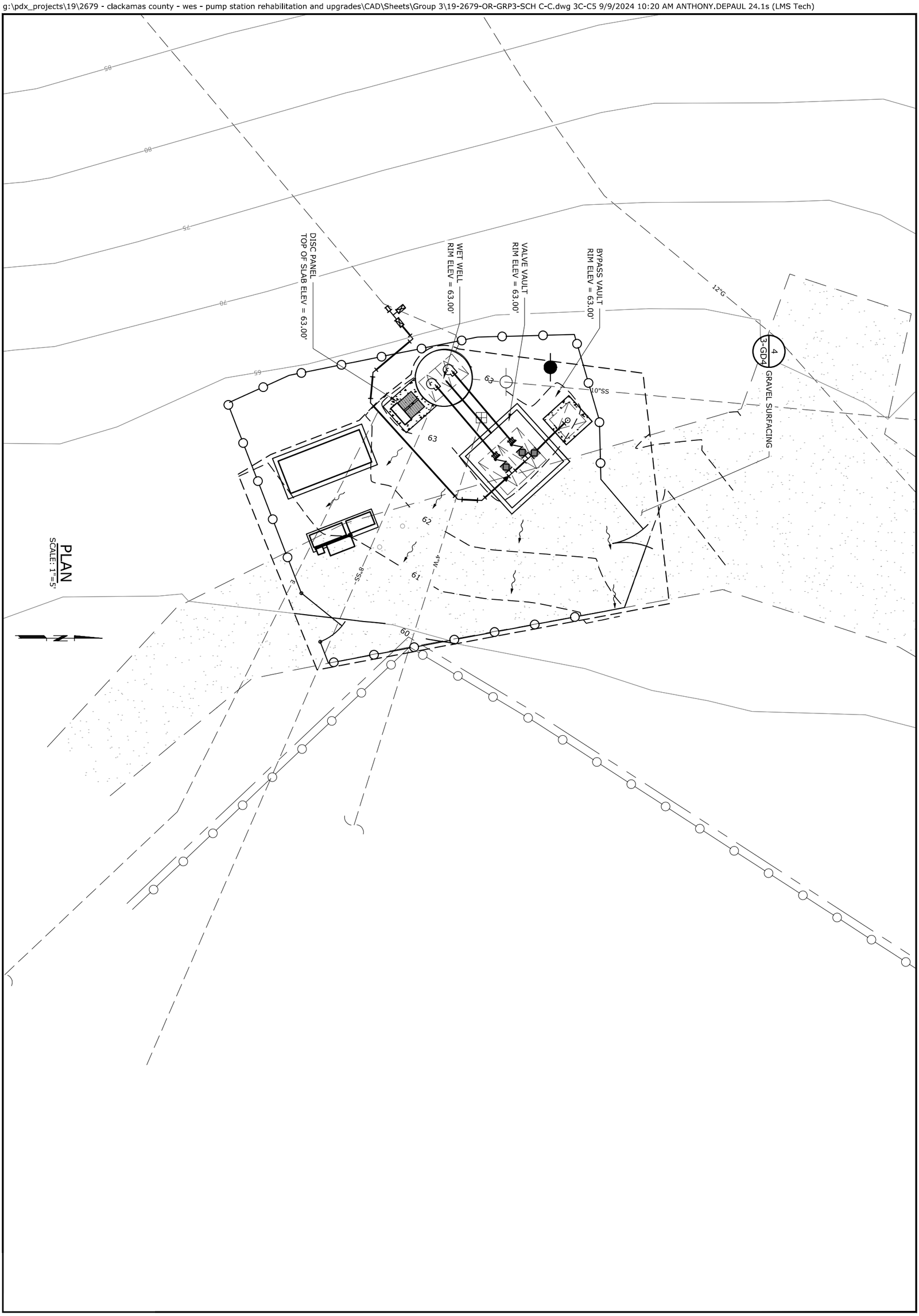
consor

DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH C-C.dwg 3C-C4 9/9/2024 10:20 AM ANTHONY.DEPAUL 24.1s (LMS Tech)



PLAN
SCALE: 1"=5'

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
SURFACING AND GRADING PLAN

CLACKAMAS WATER ENVIRONMENT SERVICES
consor

PROJECT: 19-2679 DATE: MAY 2025

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

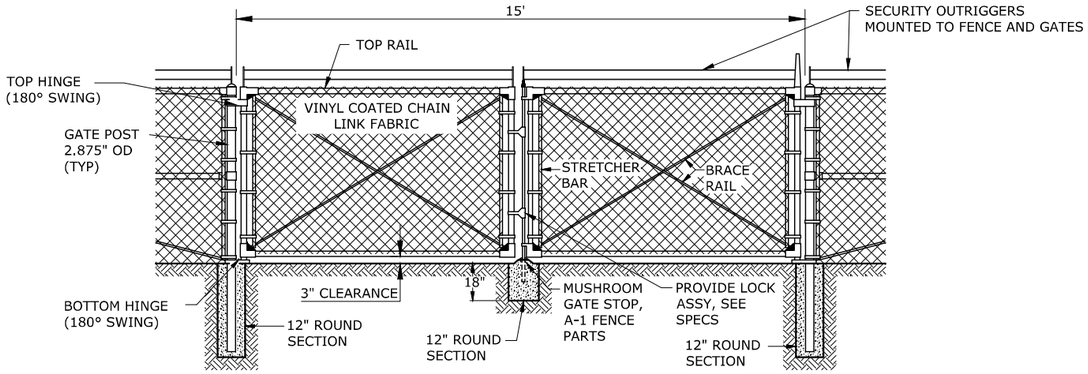
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER
OREGON
NICHOLAS SCOTT LAFRENZ
RENEWS 12-31-26

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3C-C5
112 of 184



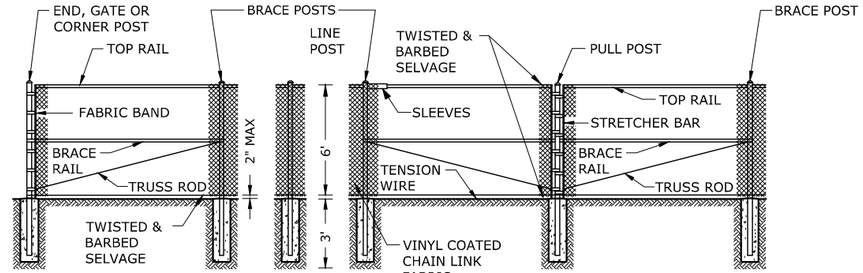
NOTE:

1. PROVIDE LOCK ASSEMBLY AND GATE STOP FOR EACH GATE, SEE SPECIFICATIONS.

DOUBLE SWING GATE

SCALE: NTS

1
3C-C4



NOTES:

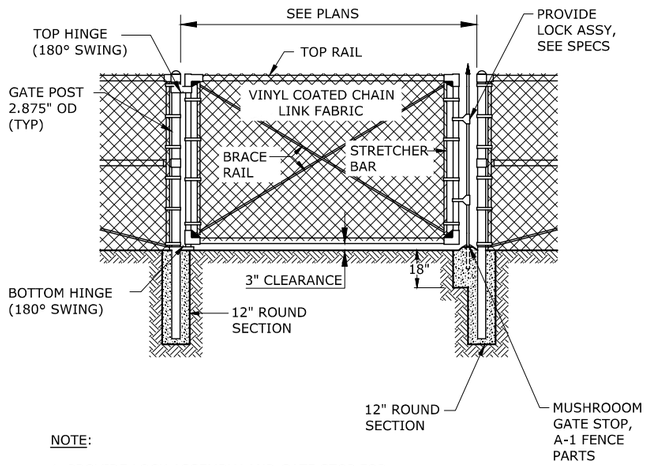
1. LAYOUT AND INSTALL FENCE POSTS TO MAINTAIN MAXIMUM 2" SPACE BETWEEN BOTTOM OF FENCE AND GROUND SURFACE.

2. CHAIN LINK FENCE FENCE TO BE COATED AND COLORED PER SPEC SECTION 32 31 13.

CHAINLINK FENCE

SCALE: NTS

2
3C-C4



NOTE:

1. PROVIDE LOCK ASSEMBLY AND GATE STOP FOR EACH GATE, SEE SPECIFICATIONS.

SINGLE SWING GATE

SCALE: NTS

3
3C-C4

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET
3C-C6
113 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
98172PE
Nicholas Paul Nielsen Laferriz
Date: 12/31/25
RENEWS 12-31-26

OREGON
JULY 1, 1971
EXPIRES: 12/31/25

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
CIVIL DETAILS

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

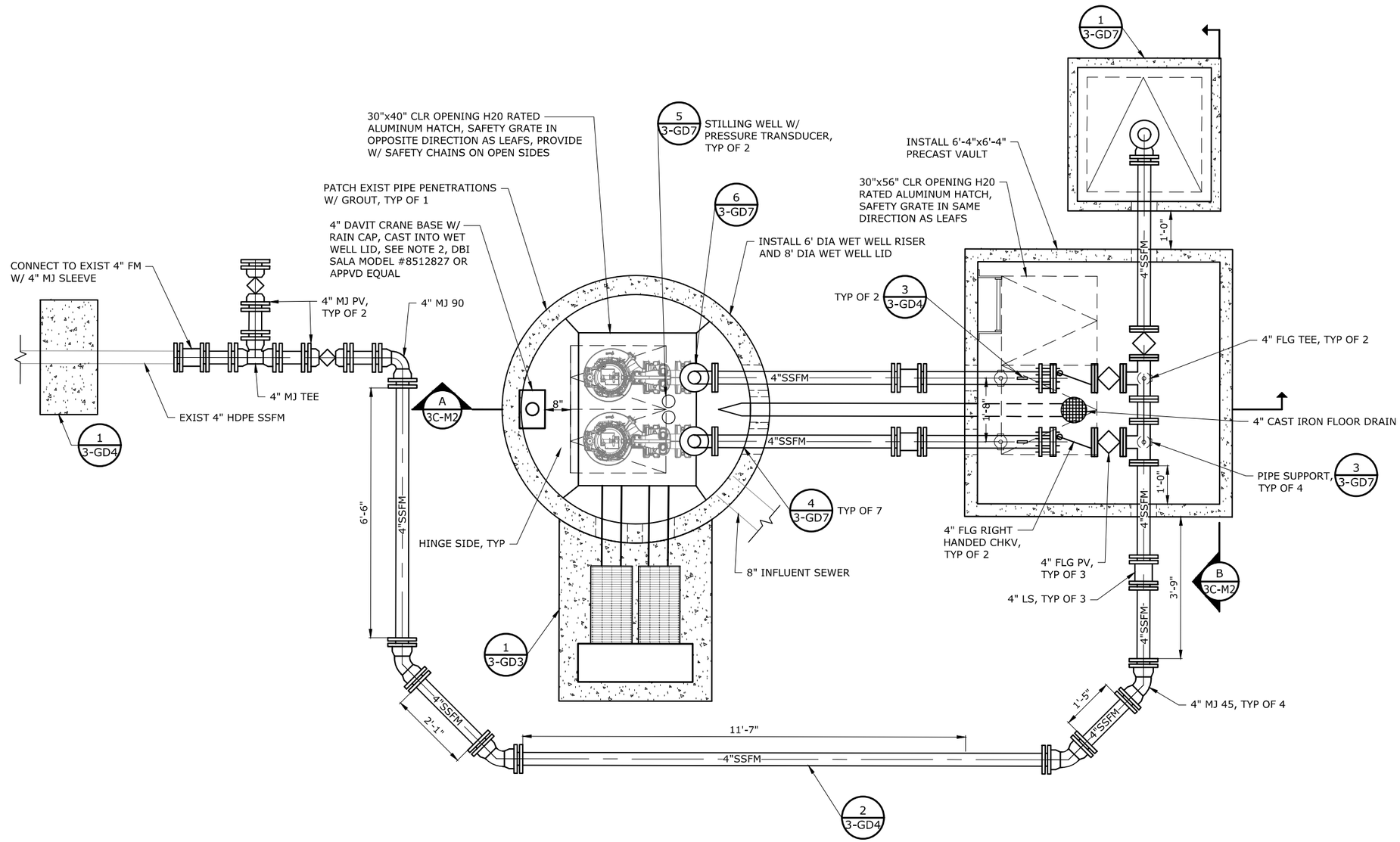
PROJECT: 19-2679
DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH C-C.dwg 3C-C6 9/9/2024 10:20 AM ANTHONY.DEPAUL 24.1s (LMS Tech)

SHEET NOTE:

1. ALL PIPE TO BE MECHANICALLY RESTRAINED.

2. DAVIT CRANE LOCATION IS APPROXIMATE, CONTRACTOR TO COORDINATE WET WELL LID REINFORCEMENT TO PROVIDE ADEQUATE SUPPORT FOR DAVIT CRANE.



PLAN
SCALE: 1"=1-1/2'

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH C-M.dwg 3C-M1 4/28/2025 3:45 PM NICK.MCFADDIN 24.1s (LMS Tech)

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3C-M1
114 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 OREGON Nicholas S. Lafrenz Date: 12/31/2026
RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

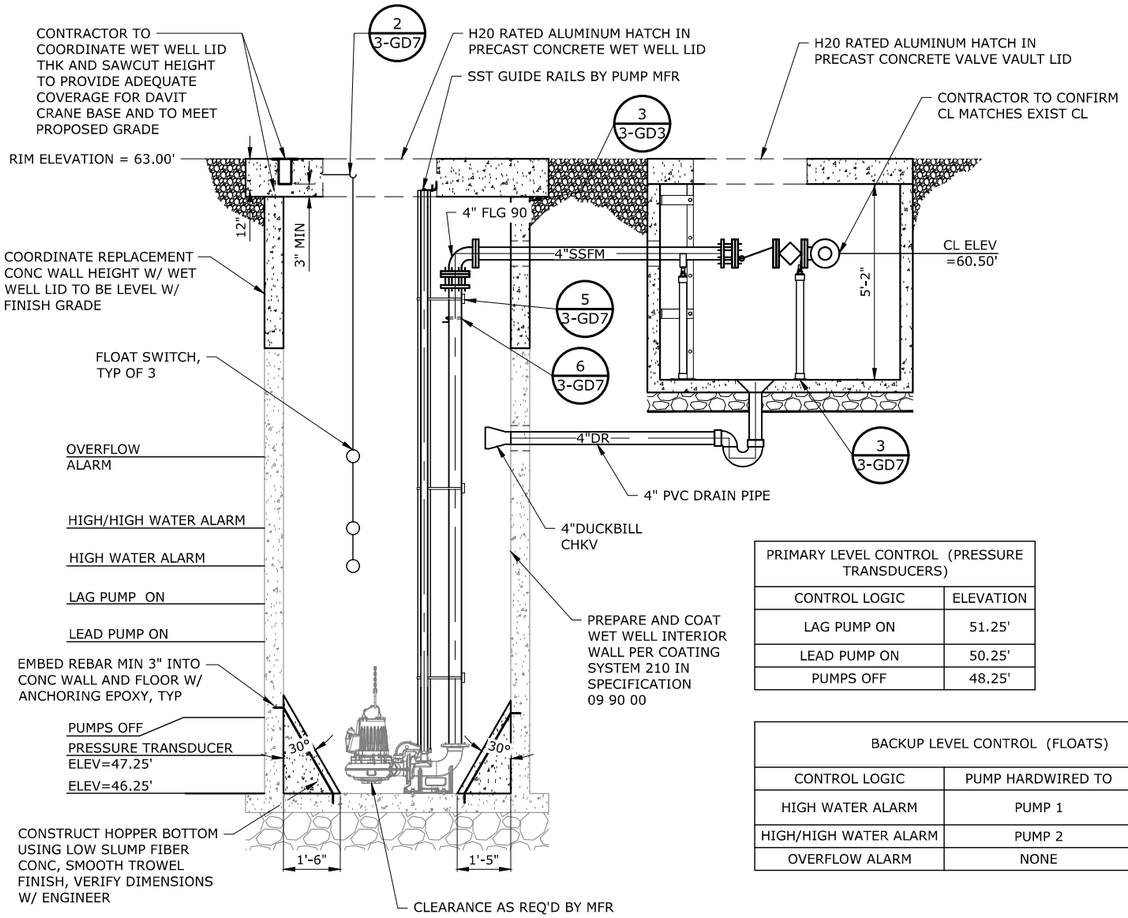
82ND DR PUMP STATION
WET WELL AND VAULT PLAN

consor

DATE: MAY 2025

PROJECT: 19-2679

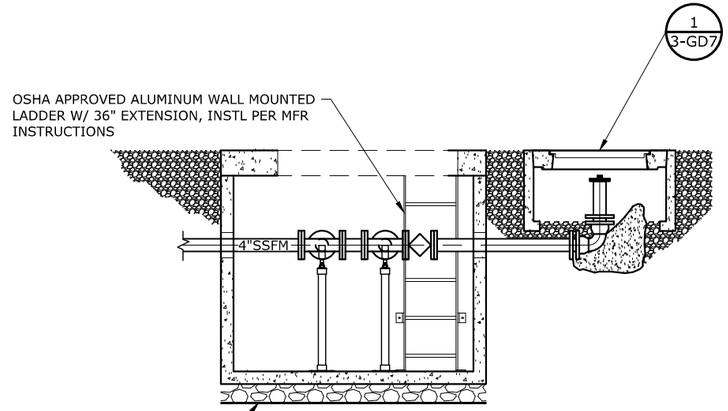
CLACKAMAS WATER ENVIRONMENT SERVICES



SECTION
SCALE: 1/2"=1'-0"
A
3C-M1

PRIMARY LEVEL CONTROL (PRESSURE TRANSDUCERS)	
CONTROL LOGIC	ELEVATION
LAG PUMP ON	51.25'
LEAD PUMP ON	50.25'
PUMPS OFF	48.25'

BACKUP LEVEL CONTROL (FLOATS)		
CONTROL LOGIC	PUMP HARDWIRED TO	ELEVATION
HIGH WATER ALARM	PUMP 1	52.25'
HIGH/HIGH WATER ALARM	PUMP 2	53.25'
OVERFLOW ALARM	NONE	55.15'



SECTION
SCALE: 1/2"=1'-0"
B
3C-M1

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: EPK
APPROVED: NSL

SHEET 3C-M2
115 of 184

REGISTERED PROFESSIONAL ENGINEER
98172
OREGON
Nicholas S. Laferriere
Date:
RENEWS 12-31-26

REGISTERED PROFESSIONAL ENGINEER
OREGON
LLOYD J. HILLMAN
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

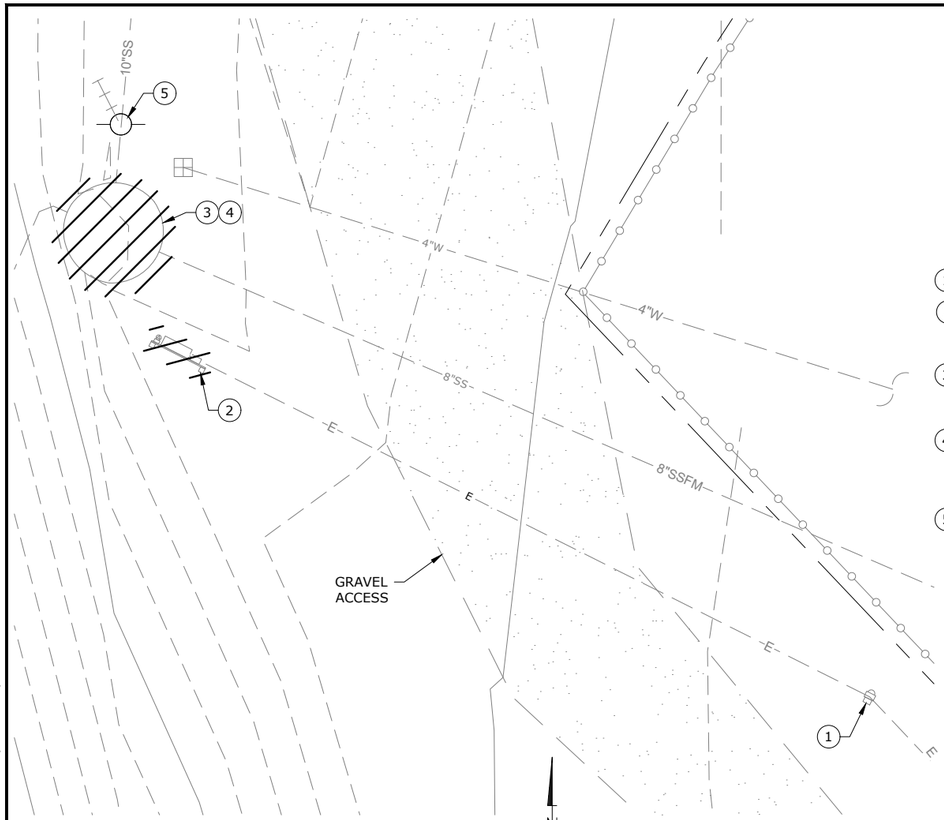
82ND DR PUMP STATION
WET WELL AND VAULT SECTIONS

consor

DATE: MAY 2025
19-2679
PROJECT:

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabiltation and upgrades\CAD\Sheets\Group 3\19-2679-OR-GRP3-SCH C-M.dwg 3C-M2 4/28/2025 3:45 PM NICK.MCFADDIN 24.1s (LMS Tech)



ELECTRICAL DEMO PLAN
SCALE: 1"= 5'

GENERAL NOTES

1. EXISTING STATION TO BE DEMO'D. CONTACTOR TO REMOVE ALL ELECTRICAL EQUIPMENT CONDUITS AND WIRING. EQUIPMENT SHOWN IS FOR REFERENCING MAJOR EQUIPMENT AND DOES NOT INDICATE ALL ITEMS SUCH AS LIGHTING RECEPTACLES, ETC.
2. CONTRACTOR TO COORDINATE WITH OWNER TO SALVAGE COMPONENTS BEFORE DEMOLITION OCCURS.

KEY NOTES

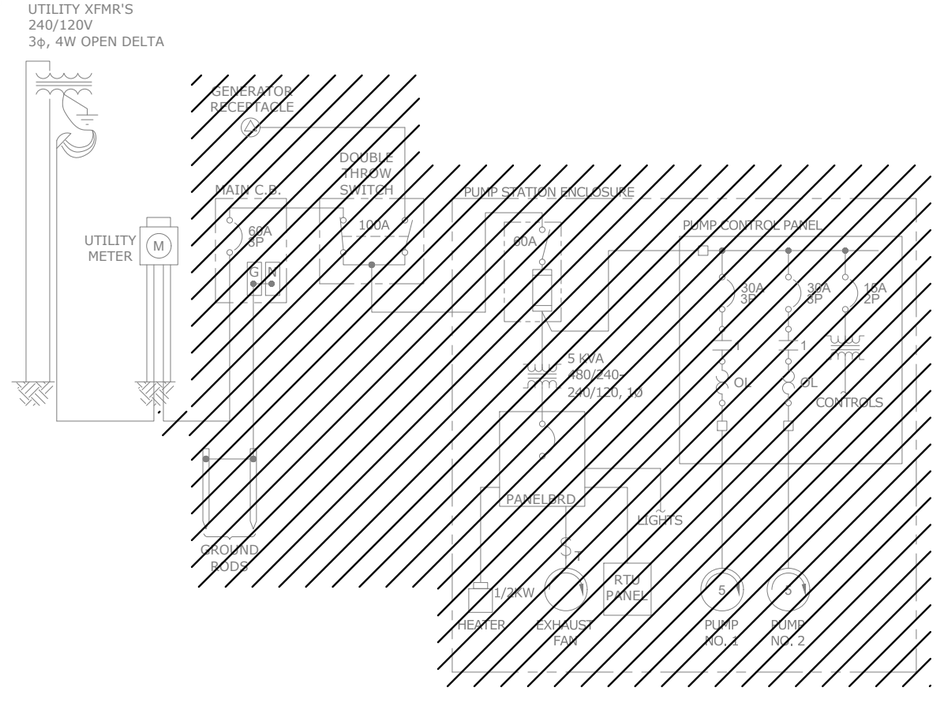
(1) EXISTING UTILITY METER.

(2) EXISTING MAIN BREAKER, DOUBLE THROW SWITCH AND GENERATOR RECEPTACLE ON BACKBOARD. SEE DETAIL 1

(3) EXISTING SUB-GRADE PUMP STATION. ALL ELECTRICAL EQUIPMENT TO BE DEMO'D. SEE DETAILS 2, 3 AND 4.

(4) EXISTING RADIO AND RTU PANEL EQUIPMENT TO BE SALVAGED AND RE-USED IN NEW RTU PANEL. SEE IC SHEETS FOR ADDITIONAL INFORMATION. SEE DETAL 4.

(5) EXISTING ANTENNA POLE TO BE REMOVED. RELOCATE EXISTING ANTENNA TO NEW POLE LOCATION. SEE SHEET 3C-E2.



ONE-LINE DIAGRAM - DEMO
SCALE: NTS



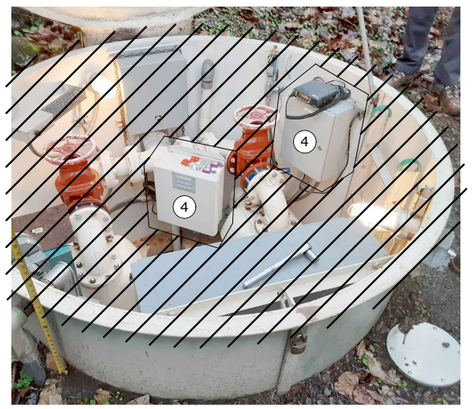
MAIN C.B, DOUBLE THROW SWITCH AND GEN. RECEPT. ELEV (1)
SCALE: NONE



PUMP STATION ENCLOSURE (2)
SCALE: NONE



PUMP CONTROL PANEL, XFMR AND PUMP STATION INTERIOR (3)
SCALE: NONE



RTU, RADIO EQUIPMENT AND PUMP STATION INTERIOR (4)
SCALE: NONE

Industrial Systems INC
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e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

SHEET 3C-E1
116 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2004 MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
ELECTRICAL
DEMOLITION PLAN

consor

PROJECT: 19-2679
DATE: MAY 2025

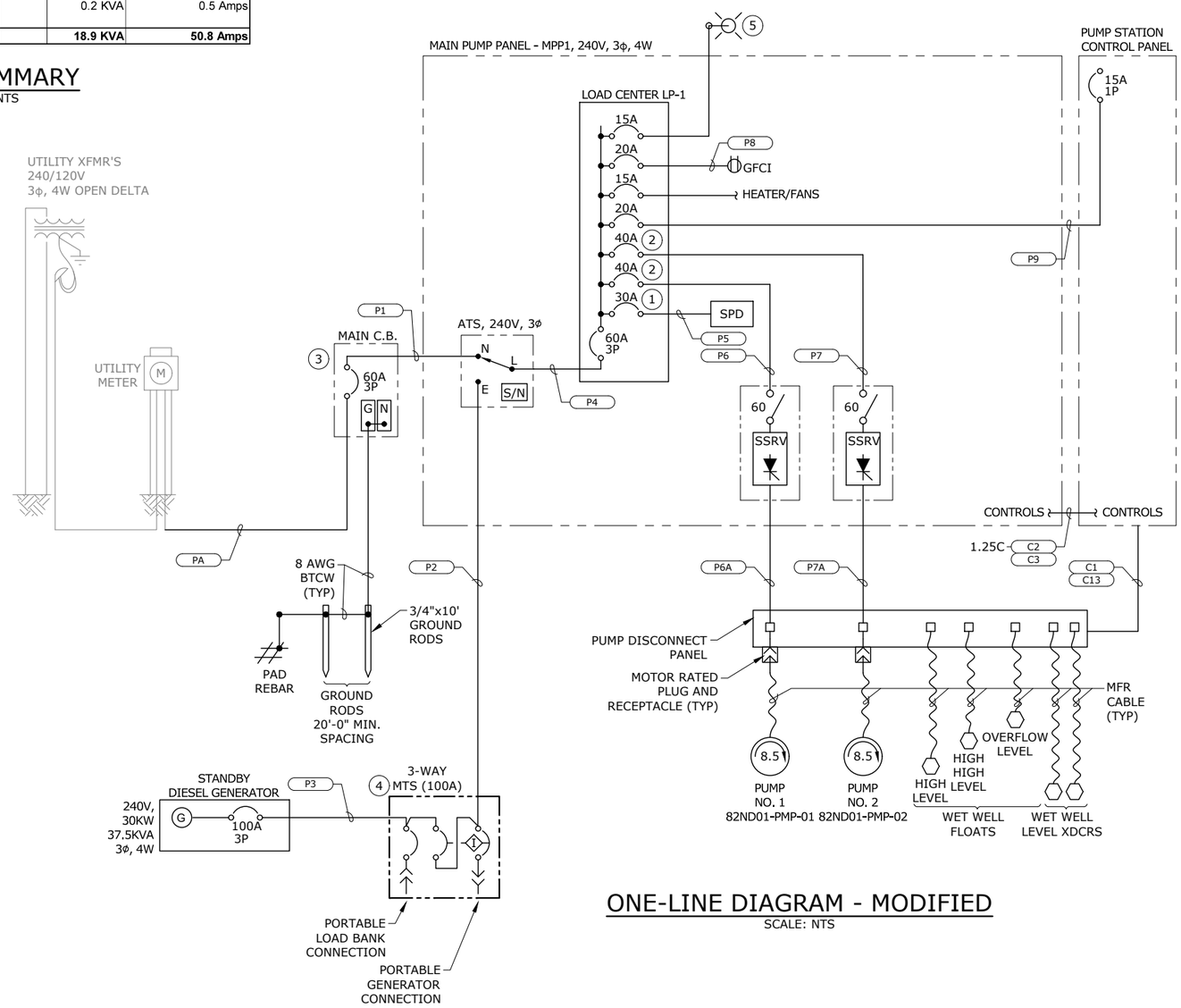
CLACKAMAS WATER ENVIRONMENT SERVICES

P:\Projects\20.18.02_MSA_WES_Final_Design\DWG\Group 3\3C-E1-82nd Drive.dwg 3C-E1 5/6/2025 8:40 AM ROBERTC 23.1s (LMS Tech)

LOAD SUMMARY		LOAD		
QTY.	DESCRIPTION	HP	KVA	AMPS @ 240 VAC
	MOTOR LOADS			
1	PUMP #1	8.5	7.9 KVA	19.0 Amps
1	PUMP #2	8.5	7.9 KVA	19.0 Amps
	OTHER LOADS			
1	HEATING *		0.2 KVA	1.7 Amps
1	VENTILATION *		0.2 KVA	1.7 Amps
1	CONTROL POWER *		0.5 KVA	4.2 Amps
	* - AMP LOAD IS 1-PHASE 120V			
	SUBTOTAL		**16.7**	**45.5**
	LARGEST MOTOR X 25%		2.0 KVA	4.7 Amps
	NON-MOTOR LOADS X 25%		0.2 KVA	0.5 Amps
	TOTAL		**18.9 KVA**	**50.8 Amps**

LOAD SUMMARY

SCALE: NTS



ONE-LINE DIAGRAM - MODIFIED

SCALE: NTS

KEY NOTES

1. SIZE AS RECOMMENDED BY MANUFACTURER OF SPD.
2. VERIFY SIZE WITH MANUFACTURER OF SOFT STARTER PROVIDED.
3. PROVIDE WARNING SIGN READING "UTILITY SERVICE DISCONNECT DOES NOT DISCONNECT GENERATOR".
4. 3-WAY MANUAL TRANSFER SWITCH WITH CAM-LOCK CONNECTORS.
5. LUMINAIRE W/PHOTOCELL FOR DUSK TO DAWN CONTROL ON EQUIPMENT STRUT FRAME.

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
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APPROVED: MEW

SHEET 3C-E2 117 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2010 MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
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0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
ELECTRICAL
ONE-LINE DIAGRAM

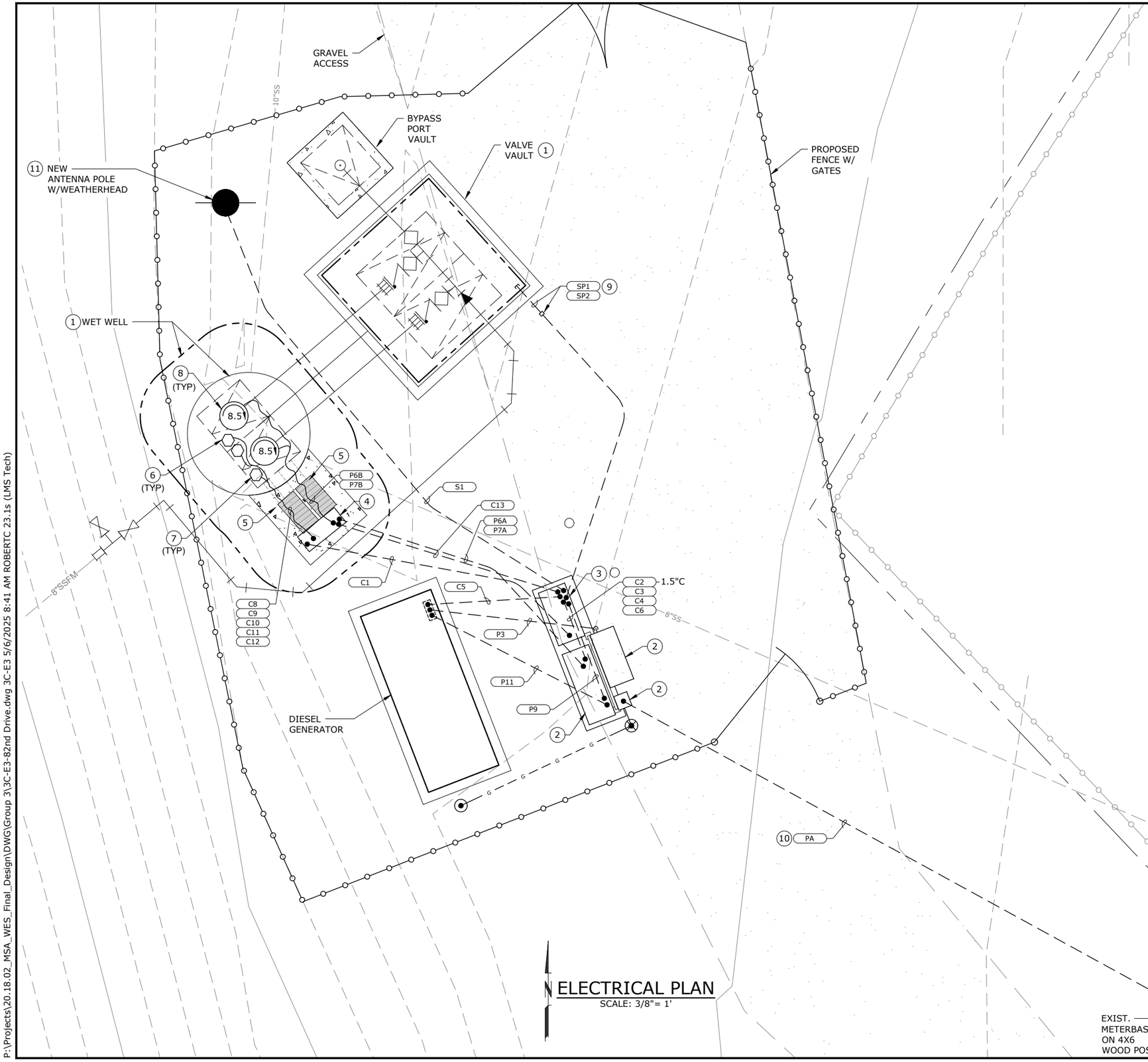
consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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PROJECT#: 20.18.02

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ELECTRICAL PLAN
SCALE: 3/8"= 1'

GENERAL NOTES

1. SEE SHEET 3C-E5 FOR CONDUIT AND CIRCUIT SCHEDULE.
2. SEE SHEET 3-GD6 FOR TYPICAL CONDUIT TRENCHES AND TRANSITION.
3. COORDINATE DISCONNECT/RECONNECT WITH UTILITY COMPANY FOR INTERCEPTION/EXTENSION OF CONDUIT AND REPLACEMENT OF CONDUCTORS FROM EXISTING METERBASE TO NEW MAIN PUMP PANEL.

KEY NOTES

(1) CLASS 1 DIV. 2 GROUP D SPACE IN AN ENVELOPE 18" ABOVE GRADE 3' LATERALLY FROM TRENCH AND SLEEVE OPENINGS FOR WET WELL AND CLASS 1 DIV. 2 GROUP D SPACE INSIDE OF VALVE VAULT. INTERIOR OF WET WELL IS CLASS 1 DIV. 1 GROUP D SPACE

(2) MAIN PUMP PANEL (MPP-1) WITH MAIN CIRCUIT BREAKER, LIGHT AND 3-WAY MTS ON STRUT FRAME. SEE ONE-LINE DIAGRAM SHEET 3C-E2, SHEET 3C-E4 AND SHEETS 3C-E6 AND 3C-E7 FOR ADDITIONAL INFORMATION.

(3) PUMP STATION CONTROL PANEL. SEE 3C-IC SHEETS FOR ADDITIONAL INFORMATION.

(4) PUMP DISCONNECT PANEL WITH PUMP RECEPTACLES AND PLUGS. SEE SHEET 3C-E8.

(5) PUMP CABLING TRENCH WITH PIPE SLEEVE FOR ROUTING OF PUMP AND LEVEL CONTROLS MANUFACTURER'S CABLES. SEE SHEETS 3C-M1 AND 3C-M2.

(6) WET WELL LEVEL SENSORS, PT-1001 & PT-1002 IN STILLING WELLS. SEE SHEET 3C-M1, 3C-M2 AND 3-GD6 FOR LOCATION AND INSTALLATION INFORMATION.

(7) FLOAT SWITCHES, LSH-1010, LSHH-1010, LSHH-1011 IN WET WELL. SEE SHEET 3C-M1, 3C-M2 AND 3-GD6 FOR LOCATION AND INSTALLATION INFORMATION.

(8) SUBMERSIBLE PUMPS WITH MFR CABLING ROUTED TO PUMP DISCONNECT PANEL VIA CABLE TRENCH AND SLEEVES.

(9) CONDUITS ARE ENTERING HAZARDOUS AREA; PROVIDE TRANSITION 12" OUTSIDE VAULT FROM PVC TO RGS TO MAINTAIN CONTINUOUS CONDUITS TO FUTURE SEAL OFFS. SEAL AND CAP FOR FUTURE.

(10) INTERCEPT EXISTING CONDUIT AND ROUTE TO NEW MAIN CIRCUIT BREAKER. INSTALL NEW CONDUCTORS AS REQUIRED.

(11) RELOCATE EXISTING ANTENNA FROM EXISTING POLE BEING REMOVED. INSTALL NEW CONDUIT AND COAX CABLE UP SIDE OF NEW POLE AND PROVIDE WEATHERHEAD AT TOP FOR BREAKOUT. INSTALL COAX WITH DRIP LOOP AND SEAL EXTRA WEATHERHEAD OPENINGS WITH RTV SILICONE.

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NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

SHEET 3C-E3
118 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
88305PE
MAY 14, 2019
MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN
NOTICE
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0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
ELECTRICAL
SITE PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

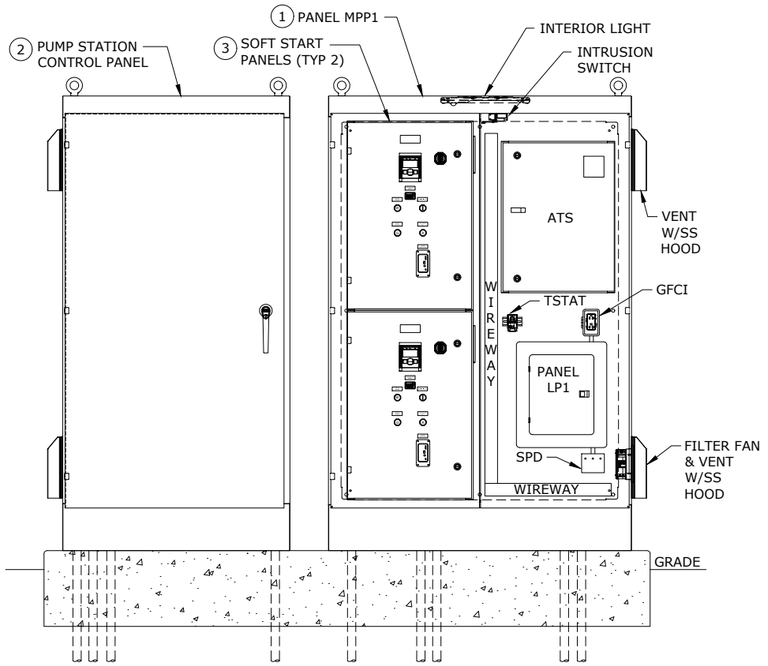
PROJECT: 19-2679 DATE: MAY 2025

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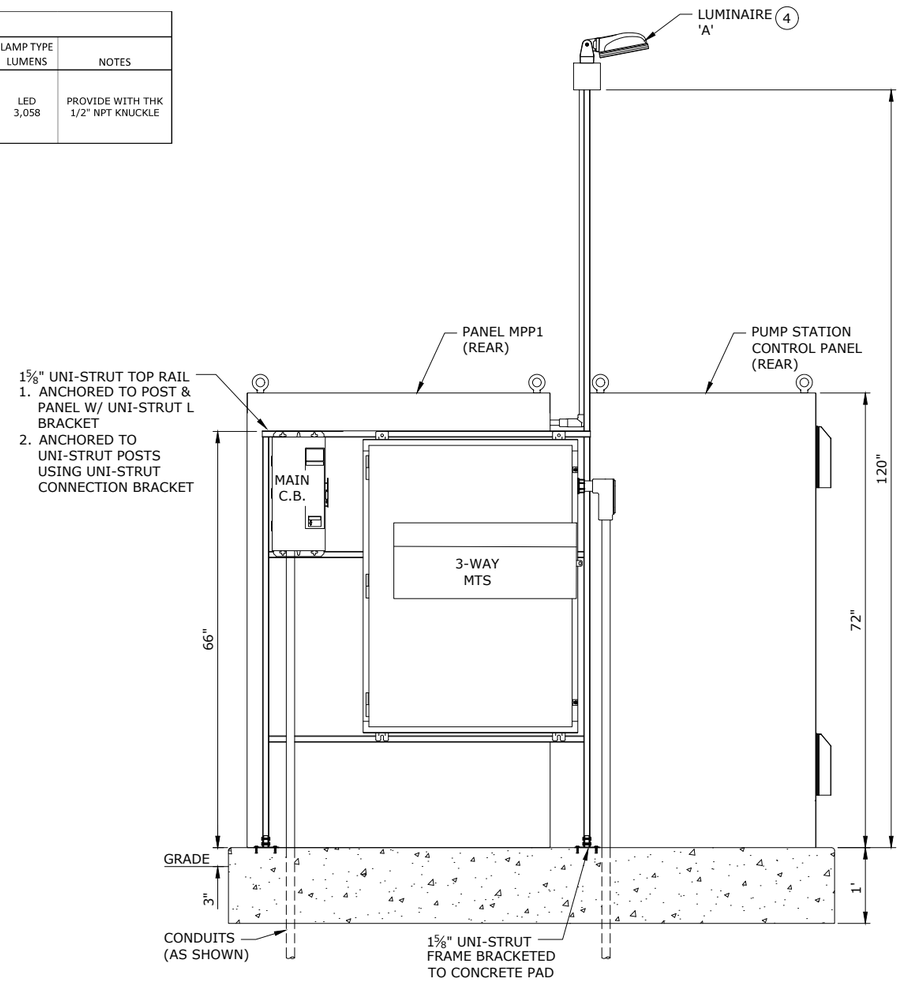
LUMINAIRE SCHEDULE									
TYPE	DESCRIPTION	MOUNTING	VOLTAGE	INPUT WATTS	MANUFACTURER PART NUMBER	BATTERY BACKED	COLOR TEMP	LAMP TYPE LUMENS	NOTES
A	HIGH PERFORMANCE LED, WET LOCATION FLOOD LIGHT WITH BRONZE DIE CAST ALUMINUM HOUSING AND INTERNAL HEAT SINK. SINGLE ENGINE PACKAGE WITH WIDE FLOOD RECTANGLE DISTRIBUTION AND PHOTOCELL.	STRUT W/JBOX	120/277V	21	LITHONIA LIGHTING: DSXF1 LED SERIES OR AS APPROVED.	NO	40K	LED 3,058	PROVIDE WITH THK 1/2" NPT KNUCKLE

KEY NOTES

1. EXTERIOR DOORS OF PANEL 'MPP1' NOT SHOWN. PANEL IS SAGINAW SCE-724818SSFSD. PROVIDE WITH VENTS, FANS AND HOODS WITH A MININUM 100 CFM CONTROLLED BY INTERIOR THERMOSTAT.
2. SEE IC SHEET FOR PUMP STATION CONTROL PANEL INFORMATION.
3. SEE SHEETS 3C-E6 AND 3C-E7 FOR ADDITIONAL INFORMATION.
4. COORDINATE AIMING OF LUMINAIRE WITH OWNER.



SIDE FACING GENERATOR



PARKING AREA SIDE

ELECTRICAL PANEL ELEVATIONS

SCALE: 1"= 1'

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NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
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APPROVED: MEW

SHEET 3C-E4
119 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2010 MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
ELECTRICAL
ELEVATION DETAILS

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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ALL CIRCUITS ARE IDENTIFIED ON THE PLANS WITH THE DIAMOND SYMBOL. CONDUCTOR SIZES ARE BASED ON COPPER CONDUCTORS. CONDUIT SIZES ARE SHOWN FOR CASES WHEN CIRCUIT CONDUCTORS ARE RUN WITHOUT OTHER CIRCUITS. MULTIPLE CIRCUITS RUN IN COMMON CONDUITS ARE SHOWN ON PLANS AND SUPERSEDE THE BASIC CONDUIT SIZE SHOWN.

RACEWAY SIZES ARE IN INCHES WITH QUANTITIES IN EXCESS OF (1) SHOWN IN ADJACENT PARENTHESIS. CONDUCTOR CONFIGURATIONS ARE CODED AS FOLLOWS: P- FOR POWER CONDUCTORS, G - FOR GROUND CONDUCTORS, N - FOR NEUTRAL CONDUCTORS, C - FOR CONTROL CONDUCTORS, TSP - FOR TWISTED SHIELDED PAIR, AND SP - FOR SPARE CONDUCTORS.

CIRCUITS REVISED SINCE LAST ISSUE ARE INDICATED BY AN ASTERISK(*).

CIRCUIT NUMBER	FROM	TO	CONDUCTORS	RACEWAY	NOTES
PA	EXISTING METERBASE	MAIN CIRCUIT BREAKER	(3) 4 AWG, P (1) 4 AWG, N	EXIST	INTERCEPT EXISTING AND RE-ROUTE
P1	MAIN CIRCUIT BREAKER	AUTOMATIC TRANSFER SWITCH (ATS)	(3) 4 AWG, P (1) 4 AWG, N (1) 8 AWG, G	1	
P2	ATS	3-WAY MANUAL TRANSFER SWITCH (MTS)	(3) 4 AWG, P (1) 4 AWG, N (1) 8 AWG, G	1	
P3	3-WAY MTS	GENERATOR	(3) 4 AWG, P (1) 4 AWG, N (1) 8 AWG, G	1	
P4	ATS	LP-1	(3) 4 AWG, P (1) 4 AWG, N (1) 8 AWG, G	1	
P5	LP-1	SURGE PROTECTOR	(3) 8 AWG, P (1) 8 AWG, N (1) 8 AWG, G	3/4	
P6	LP-1	SSRV 1 CONTROL PANEL	(3) 8 AWG, P (1) 10 AWG, G	3/4	
P6A	SSRV 1 CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(3) 8 AWG, P (1) 18 AWG, TSP (1) 10 AWG, G	1	PUMP 1 POWER PUMP THERMAL/LEAK CKT
P6B	PUMP DISCONNECT PANEL (PDP)	PUMP 1	MFR CABLE	TRENCH	
P7	LP-1	SSRV 2 CONTROL PANEL	(3) 8 AWG, P (1) 10 AWG, G	3/4	
P7A	SSRV 2 CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(3) 8 AWG, P (1) 18 AWG, TSP (1) 10 AWG, G	1	PUMP 2 POWER PUMP THERMAL/LEAK CKT
P7B	PUMP DISCONNECT PANEL (PDP)	PUMP 2	MFR CABLE	TRENCH	
P8	LP-1	RECEPTACLE	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	1/2	
P9	LP-1	PUMP STATION CONTROL PANEL	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
P10	LP-1	EXHAUST FAN EF-1	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	1	
P11	LP-1	GENERATOR	(2) 12 AWG, P (2) 12 AWG, N (1) 12 AWG, G	3/4	BLOCK HTR / BATTERY CHGR CKT
P12	LP-1	AREA LIGHT AT STRUT FRAME	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	1/2	
C1	PUMP STATION CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(2) 18 AWG, TSP (6) 14 AWG, C (1) 14 AWG, G	1	NEW LEVEL SENSOR CABLES LO, HI, & HI-HI FLOATS (INSTRINSIC SAFE - KEEP SEPARATE)
C2	PUMP STATION CONTROL PANEL	SSRV 1 CONTROL PANEL	(14) #14 AWG, C (1) #14 AWG, G (2) #14 AWG, SP	1	PUMP 1 CONTROL
C3	PUMP STATION CONTROL PANEL	SSRV 2 CONTROL PANEL	(14) #14 AWG, C (1) #14 AWG, G (2) #14 AWG, SP	1	PUMP 2 CONTROL
C4	PUMP STATION CONTROL PANEL	ATS	(4) 14 AWG, C (1) 14 AWG, G (2) 14 AWG, SP	1	ATS POS SIGNALS
C5	PUMP STATION CONTROL PANEL	GENERATOR	(4) 14 AWG, C (1) 14 AWG, G (2) 14 AWG, SP	1	RUN & FAULT SIGNALS
C6	PUMP STATION CONTROL PANEL	INTRUSION SWITCH	(2) 14 AWG, C (1) 14 AWG, G	3/4	
C7	NOT USED				
C8	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL SENSOR 1	MFR CABLE	TRENCH	
C9	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL SENSOR 2	MFR CABLE	TRENCH	
C10	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL HIGH FLOAT	MFR CABLE	TRENCH	
C11	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL HIGH HIGH FLOAT	MFR CABLE	TRENCH	
C12	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL OVERFLOW FLOAT	MFR CABLE	TRENCH	
C13	PUMP STATION CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	1	
S1	PUMP STATION CONTROL PANEL	EXIST. ANTENNA @ EXISTING WOOD POLE	COAX CABLE	1	INTERCEPT AND RE-ROUTE TO NEW PANEL LOCATION. VERIFY CONDUIT SIZE AND COAX TYPE.
SP1	VALVE VAULT	PUMP STATION CONTROL PANEL	PULL CORD	1	STUB AND CAP
SP2	VALVE VAULT	PUMP STATION CONTROL PANEL	PULL CORD	1	STUB AND CAP

CIRCUIT SCHEDULE

SCALE: NTS

PANEL: LP-1	VOLTAGE: 240 1Φ 3W	MOUNTING: SURFACE
LOCATION: MPP1	BUS: 100A COPPER	AIC: 10,000
FEEDER: (SEE ONE-LINE)	MAIN: 60A	

CKT NO	CIRCUIT DESCRIPTION	BREAKER POLES	BREAKER AMPS	VA	PHASE	LOAD VA	BREAKER POLES	BREAKER AMPS	CIRCUIT DESCRIPTION	CKT NO
1	GENERATOR BLOCK HEATER	1	20	600	A	-	1	20	SPARE	2
3	BATTERY CHARGER	1	20	240	B	500	1	20	CONTROL PANEL	4
5	INTERIOR LIGHT	1	20	18	A	180	1	20	RECEPTACLE	6
7	EXTERIOR LIGHT	1	20	21	B	-	1	20	SPARE	8
9	SPARE	1	20	-	A	-	1	20	SPARE	10
11	SPARE	1	20	-	B	-	1	20	SPARE	12

LOAD PER PHASE

PHASE A	0.8	KVA
PHASE B	0.8	KVA
TOTAL LOAD	1.6	KVA
TOTAL AMPS	6	AMPS

PANEL SCHEDULE

SCALE: NTS

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NO. | DATE | REVISION | BY

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APPROVED: MEW

SHEET 3C-E5 120 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2025 MICHAEL E. WELLS
EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ.: AS SHOWN

NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
ELECTRICAL
CIRCUIT AND PANEL SCHEDULES

consor

PROJECT: 19-2679 DATE: MAY 2025

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GENERAL NOTES

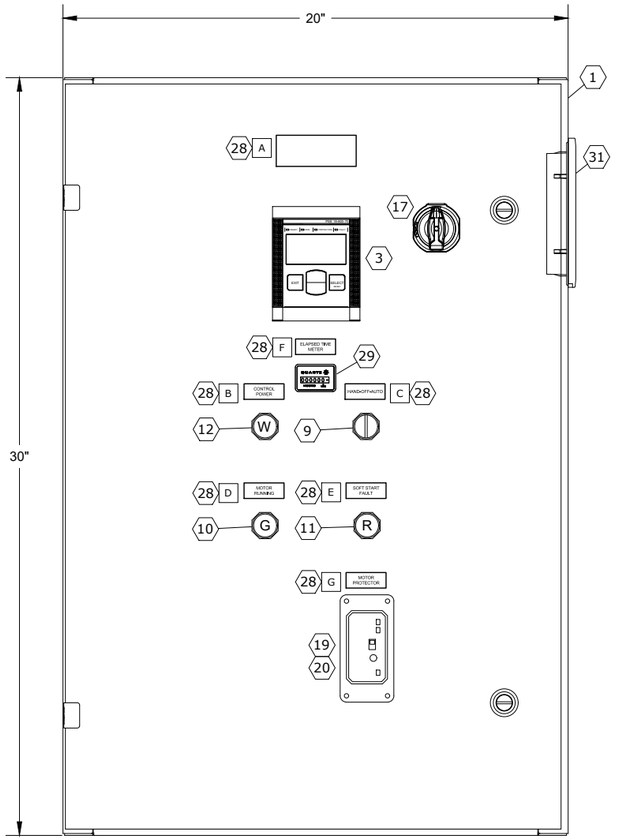
1. PANEL LAYOUT IS CONCEPTUAL AND FINALIZED LAYOUT SHALL BE PER UL 508 REQUIREMENTS AND PROVIDED BY MANUFACTURER.
2. PANEL IS TYPICAL FOR 2 UNITS, SSRV-1 (82ND01-PMP-01) AND SSRV-2 (82ND01-PMP-02).

NAMEPLATE SCHEDULE

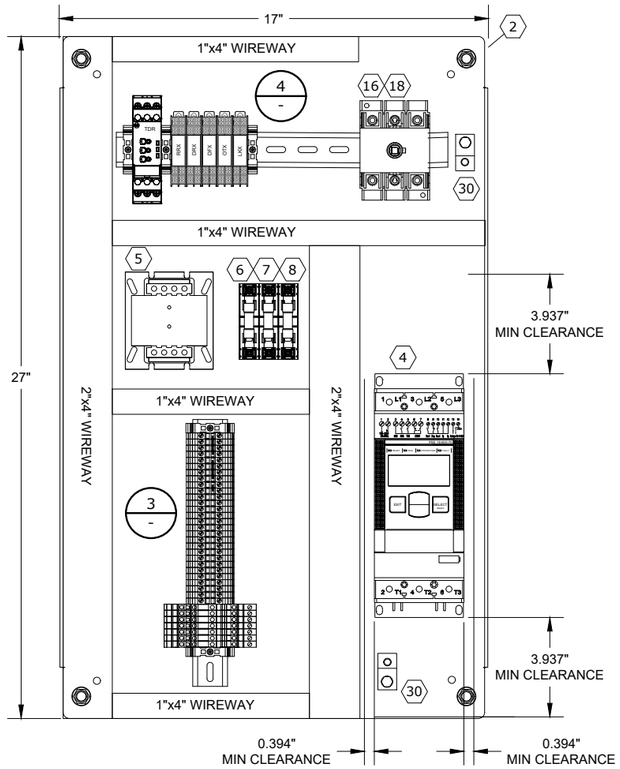
A	ITEM	NAMEPLATE SCHEDULE
	A	82ND01-PMP-0X (X=1-2)
	B	CONTROL POWER
	C	HAND-OFF-AUTO
	D	MOTOR RUNNING
	E	SOFT START FAULT
	F	ELAPSED TIME METER
	G	PUMP PROTECTION RELAY

BILL OF MATERIALS

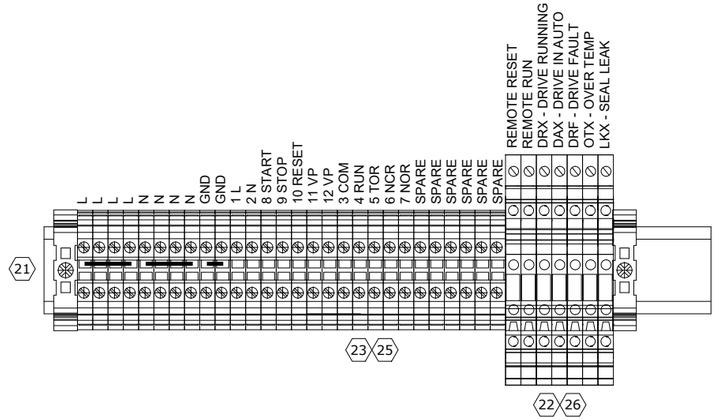
#	ITEM	MANUFACTURER	PART NUMBER	DESCRIPTION
	1	SAGINAW	SCE-30EL2010	ENCLOSURE, 30 x 20 x 10, WALL MOUNT, SINGLE DOOR, NEMA 12
	2	SAGINAW	SCE-30P20	BACKPANEL, 30 x 20
	3	ABB		EXTERNAL KEYPAD (PSEEK)
	4	ABB	PSE30-600-70	10HP (240V) ND CLASS 10 208-600V SOFT START 100-250VAC CONTROL
	5	ALLEN BRADLEY	1497-A-BASX-0-N	CONTROL TRANSFORMER
	6	ALLEN BRADLEY	1491-R171	FUSE BLOCK CLASS CC 0-30A 3 POLE
	7	MERSEN	ATDR1/4	CLASS CC FUSE - PRIMARY - 1/4 AMP
	8	MERSEN	ATDR8/10	CLASS CC FUSE - SECONDARY - 8/10 AMP
	9	ALLEN BRADLEY	800T-J2B	3 POSITION SELECTOR SWITCH
	10	ALLEN BRADLEY	800T-QTH2G	PUSH-TO-TEST, LED, PILOT LIGHT - GREEN
	11	ALLEN BRADLEY	800T-QTH2R	PUSH-TO-TEST, LED, PILOT LIGHT - RED
	12	ALLEN BRADLEY	800T-QTH2W	PUSH-TO-TEST, LED, PILOT LIGHT - WHITE
	13	IDEC	RJ2S-CL-A120	2PDT CONTROL RELAY, 120VAC
	14	IDEC	RJ2S-05BW	2PDT CONTROL RELAY BASE
	15	ALLEN BRADLEY	700-FSM78UU23	GENERAL PURPOSE TIMING RELAY, MULTI FUNCTION
	16	ALLEN BRADLEY	194U-A60-1753	DISCONNECT SWITCH DIN-RAIL MOUNTED, 60 AMP
	17	ALLEN BRADLEY	194E-SY	DISCONNECT SWITCH HANDLE RED/YELLOW
	18	ALLEN BRADLEY	194U-N1	DISCONNECT WITCH SHAFT 12"
	19	FLYGT	14-407129	MINICAS 120 PUMP MOISTURE/TEMPERATURE RELAY
	20	OMRON	P3GA-11	MINICAS 120 PUMP MOISTURE/TEMPERATURE REVERSE RELAY BASE
	21	PHOENIX CONTACT	1201730	DIN Mounting rail - 35mm
	22	PHOENIX CONTACT	3044814	M 4 FEED THROUGH MULTICONDUCTOR, MULTI-LEVEL TERMINAL
	23	PHOENIX CONTACT	3044102	M 4/6 FEED THROUGH TERMINAL - GREY
	24	PHOENIX CONTACT	3044128	M 4/6 GROUND TERMINAL - GREEN/YELLOW
	25	PHOENIX CONTACT	3047028	END SECTION - GREY
	26	PHOENIX CONTACT	3030271	ASSEMBLED JUMPER BAR 10 POLES
	27	PHOENIX CONTACT	0800886	END STOP - GREY
	28			1" x 2" WHITE LETTERS ON BLACK PHENOLIC NAMEPLATE (SEE SCHEDULE)
	29	TRUMETER	722-0002	6-DIGIT HOUR TIMEMETER INCUDING 10'THS OF HOUR
	30	BURNDY	KA2U	GROUNDING LUG #14 TO #2
	31	SAGINAW	SCE-N12FGA44	EXHAUST VENT



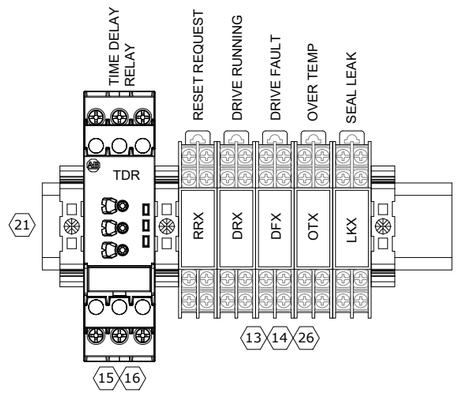
SSRV ENCLOSURE LAYOUT (1)
SCALE: 4" = 1'-0"



SSRV BACKPANEL LAYOUT (2)
SCALE: 4" = 1'-0"



TERMINAL LAYOUT (3)
SCALE: NTS



RELAY LAYOUT (4)
SCALE: NTS

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSIS804K9
AK #1018436
PROJECT#: 20.18.02

NO. | DATE | REVISION | BY
DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW
SHEET 3C-E6
121 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2004 MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE | VERT.: AS SHOWN | HORIZ.: AS SHOWN
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
ELECTRICAL
SOFT STARTER PANEL LAYOUT

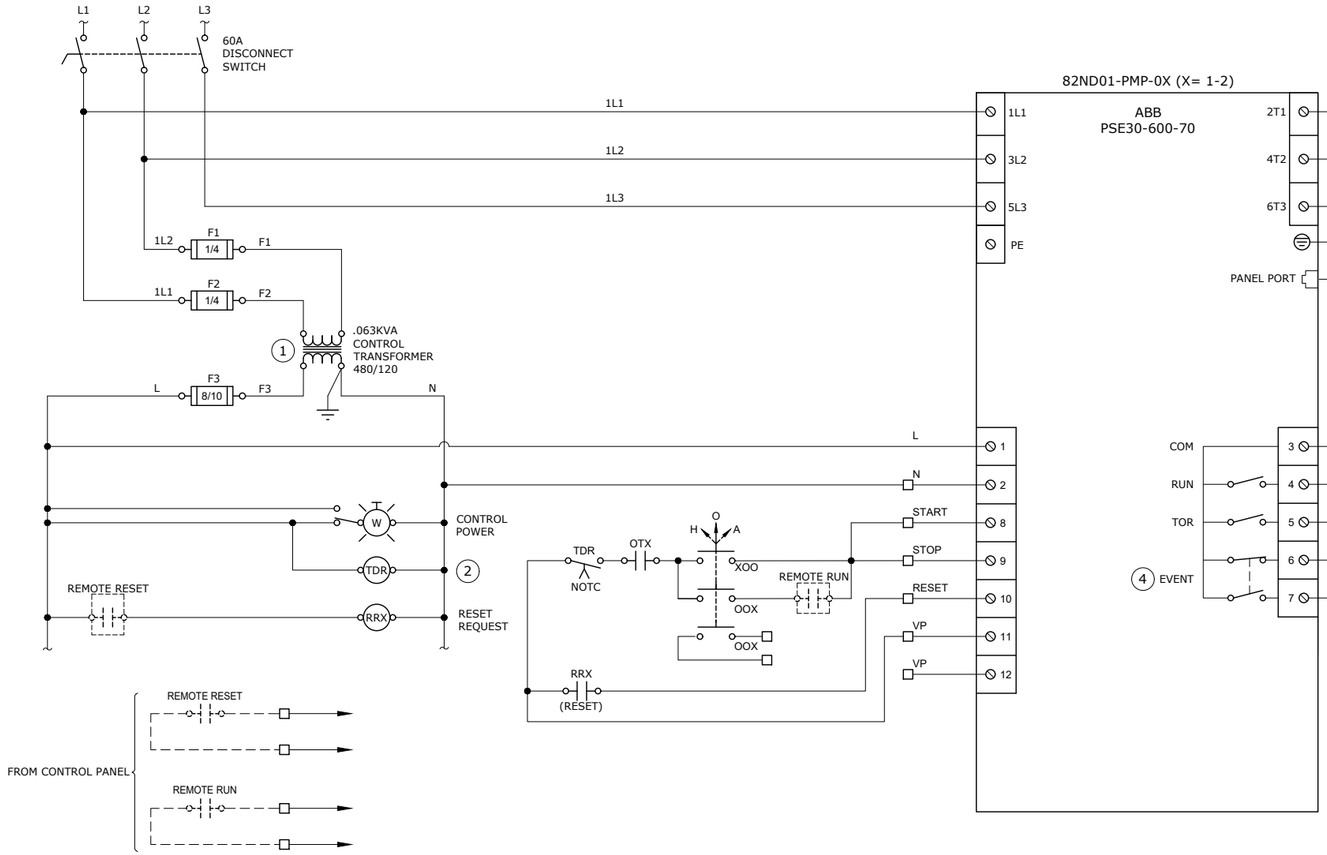
consor
DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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KEY NOTES

1. FUSING AND CPT SIZED PER PANEL DESIGN PROVIDED ON SIMILAR PREVIOUS PROJECTS. VERIFY AND MODIFY IF REQUIRED.
2. "DELAY ON ENERGIZE" TIME DELAY RELAY, 0-60 SECOND TIMER SET AT 15, & 30 SECONDS FOR PUMPS 1 & 2 RESPECTIVELY.
3. FLYGT MINICAS 120 SENSOR. THERMAL CONTACT CLOSED IN "NORMAL CONDITION", OPENING ON FAULT. LEAK CONTACT OPEN IN "NORMAL CONDITION", CLOSING ON FAULT. MOUNT IN DOOR.
4. CONTACTS ARE SHOWN IN "OFF" STATE. FAULT OUTPUT CONFIGURATIONS:
   ON = NO FAULT + DRIVE POWERED
   OFF = FAULT OR LOSS OF DRIVE POWER



MOTOR CONTROL DIAGRAM

SCALE: NTS

Industrial Systems INC
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Suite #2090
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e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: NEW
APPROVED: MEW

SHEET 3C-E7

122 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2019 MICHAEL E. WEALLS

EXPIRES: 6/30/26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE

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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
ELECTRICAL
SOFT STARTER WIRING DIAGRAM

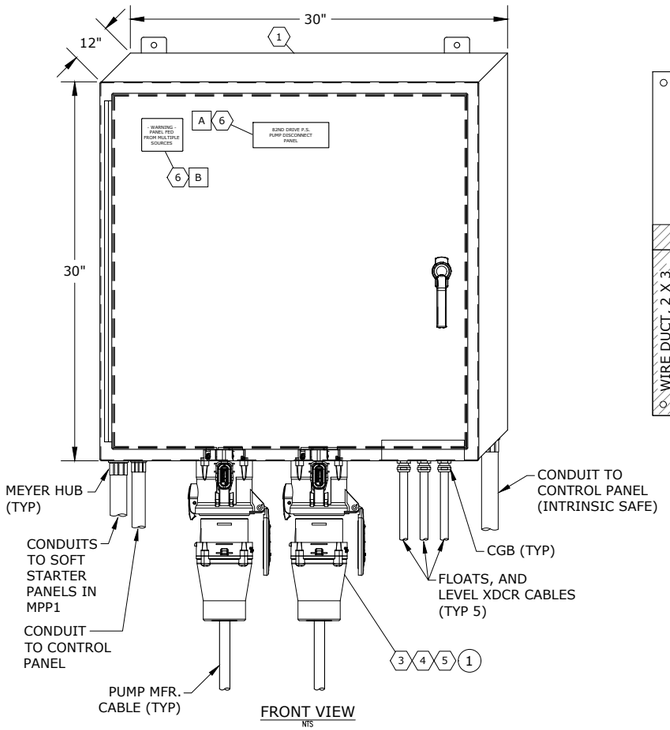
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DATE: MAY 2025

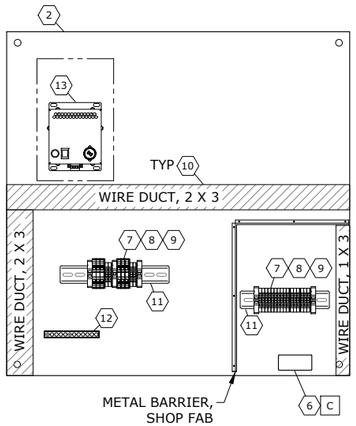
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

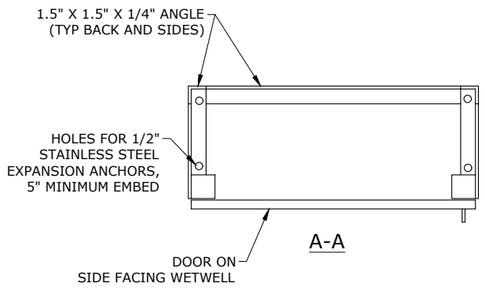
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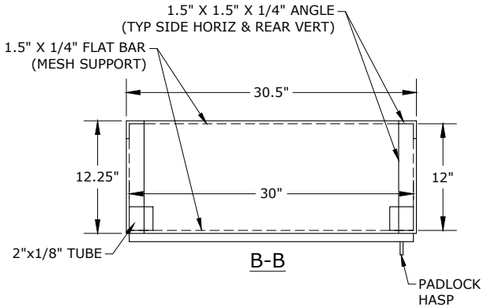


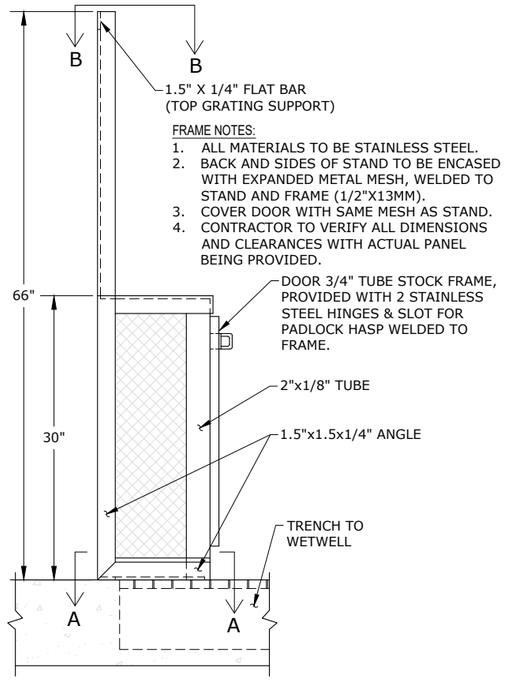
FRONT VIEW
NTS



INTERIOR VIEW
NTS

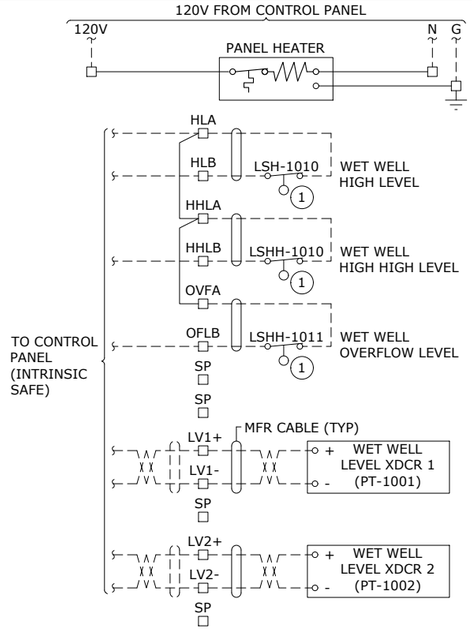


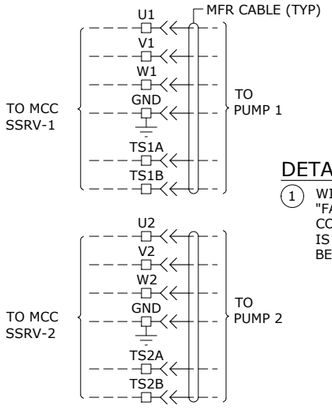




FRAME NOTES:
1. ALL MATERIALS TO BE STAINLESS STEEL.
2. BACK AND SIDES OF STAND TO BE ENCASED WITH EXPANDED METAL MESH, WELDED TO STAND AND FRAME (1/2"X13MM).
3. COVER DOOR WITH SAME MESH AS STAND.
4. CONTRACTOR TO VERIFY ALL DIMENSIONS AND CLEARANCES WITH ACTUAL PANEL BEING PROVIDED.

PUMP DISCONNECT PANEL STAND
SCALE: NONE
2
-





DETAIL NOTES

1. WIRE FLOAT FOR "FAIL-SAFE" OPERATION. CONTACT OPENS IF FLOAT IS LIFTED OR IF WIRE BECOMES DISCONNECTED.

PUMP DISCONNECT PANEL WIRING
SCALE: NONE
3
-

DETAIL NOTES

1. LABEL PUMP PLUGS AND PUMP RECEPTACLES WITH POLYPROPYLENE DYMO OR BRADY AGGRESSIVE ADHESIVE $\frac{3}{4}$" HIGH LABELS. LABEL AS "P1", AND "P2" WITH A MINIMUM SIZE 5 FONT.

A	ITEM	NAMEPLATE SCHEDULE
	A	82ND DRIVE P.S. PUMP DISCONNECT PANEL
	B	-WARNING- PANEL FED FROM MULTIPLE SOURCES
	C	INTRINSICALLY SAFE AREA

#	ITEM	QUANTITY	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	EQUALS ALLOWED
	1	1	NEMA 4 ENCLOSURE, 30"x30"x12"	SAGINAW	SCE-30EL3012SSLPPL	YES
	2	1	BACK PANEL	SAGINAW	SCE-30P30	YES
	3	2	PUMP RECEPTACLE (HP RATED SWITCH) W/AUX CONTACTS	MELTRIC	DSN SERIES	YES
	4	2	PUMP INLET (HP RATED) W/AUX CONTACTS	MELTRIC	DSN SERIES	YES
	5	2	INLET ACCESSORY HANDLE (SIZED FOR PUMP CABLE)	MELTRIC	DSN SERIES	YES
	6	3	PHENOLIC NAMEPLATE (SEE NAMEPLATE SCHEDULE)	PANEL FABRICATOR CHOICE		YES
	7	A/R	TERMINAL BLOCK (NON FUSED)	PANEL FABRICATOR CHOICE		YES
	8	A/R	TERMINAL BLOCK END STOP	PANEL FABRICATOR CHOICE		YES
	9	A/R	TERMINAL BLOCK END PLATE	PANEL FABRICATOR CHOICE		YES
	10	A/R	WIREWAY (SIZE AS NOTED ON DRAWING)	PANEL FABRICATOR CHOICE		YES
	11	A/R	DIN RAIL	PANEL FABRICATOR CHOICE		YES
	12	1	GROUND BUS	EATON C-H	GBK10	YES
	13	1	HEATER W/T-STAT, 125W	SAGINAW	SCE-HF1251A	YES

LAYOUT AND BILL OF MATERIALS
SCALE: NONE
1
-

NO. | DATE | REVISION | BY
DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW
SHEET 3C-E8
123 of 184

REGISTERED PROFESSIONAL ENGINEER 88305PE OREGON MAY 14, 2026 MICHAEL E. WELLS
EXPIRES: 6/30/26

SCALE | VERT.: AS SHOWN | HORIZ.: AS SHOWN
NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
PUMP DISCONNECT PANEL

consor
DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

Industrial Systems INC
12119 NE 99th Street
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Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

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HMI

PLC

TYPICAL 1 OF 2

WETWELL LEVEL A — LI 1002
WETWELL LEVEL B — LI 1002
WETWELL LEVEL HIGH — LSH 1010
WETWELL LEVEL HIGH HIGH — LSHH 1010
WETWELL OVERFLOW — LSHH 1011

HOA IN AUTO — YI 1111A
RUNNING — YI 1111B
FAULT — YA 1111A
OVER TEMP — YA 1111B
MOISTURE LEAK — YA 1111C
RUN COMMAND — YC 1111A
FAULT RESET COMMAND — YC 1111B

LI 1001
LI 1002
LSH 1010
LSHH 1010
LSHH 1011

YI 1111A
YI 1111B
YA 1111A
YA 1111B
YA 1111C
YC 1111A
YC 1111B

IB IB IB IB IB

1112

I SS 1
I SS 2

PT 1001
PT 1002
LSH 1010
LSHH 1010
LSHH 1011

4" FM TO DISCHARGE MH

PI 1111
PI 1112

4" FM
4" DR
4"FM

M 8.5HP
M 8.5HP

12" SS

VALVE VAULT
WET WELL
INFLUENT MANHOLE

TO BYPASS PORT

C:\AutoCAD Projects\V255 WES Pump Station Design\82ND\82ND_PID.dwg 3C-IC1 5/5/2025 12:59 PM PEI 24.0s (LMS Tech)

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC1 124 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — DEC. 17, 2024 — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.: NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
P&ID

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

DATE: MAY 2025
PROJECT: 19-2679

PORTLAND Engineering Inc.

I/O	Description	Channel	Loop Sheet
AI	SPARE	SLOT 1, CH 0	3C-IC6
AI	WET WELL LEVEL 1	SLOT 1, CH 1	3C-IC6
AI	WET WELL LEVEL 2	SLOT 1, CH 2	3C-IC6
AI	SPARE	SLOT 1, CH 3	3C-IC6
AI	SPARE	SLOT 1, CH 4	3C-IC6
AI	SPARE	SLOT 1, CH 5	3C-IC6
AI	SPARE	SLOT 1, CH 6	3C-IC6
AI	SPARE	SLOT 1, CH 7	3C-IC7
DI	POWER FAIL RELAY	SLOT 2, CH 0	3C-IC7
DI	POWER SUPPLY 1 STATUS	SLOT 2, CH 1	3C-IC7
DI	POWER SUPPLY 2 STATUS	SLOT 2, CH 2	3C-IC7
DI	PANEL INTRUSION	SLOT 2, CH 3	3C-IC7
DI	MAIN PUMP PANEL INTRUSION	SLOT 2, CH 4	3C-IC7
DI	SPARE	SLOT 2, CH 5	3C-IC7
DI	SPARE	SLOT 2, CH 6	3C-IC7
DI	SPARE	SLOT 2, CH 7	3C-IC7
DI	PUMP 1 LEAK ALARM	SLOT 2, CH 8	3C-IC8
DI	PUMP 1 OVER TEMP	SLOT 2, CH 9	3C-IC8
DI	PUMP 1 HOA IN AUTO	SLOT 2, CH 10	3C-IC8
DI	PUMP 1 RUNNING	SLOT 2, CH 11	3C-IC8
DI	PUMP 1 FAULT	SLOT 2, CH 12	3C-IC8
DI	SPARE	SLOT 2, CH 13	3C-IC8
DI	SPARE	SLOT 2, CH 14	3C-IC8
DI	SPARE	SLOT 2, CH 15	3C-IC8

I/O	Description	Channel	Loop Sheet
DI	SPARE	SLOT 3, CH 0	3C-IC9
DI	SPARE	SLOT 3, CH 1	3C-IC9
DI	WET WELL HIGH FLOAT	SLOT 3, CH 2	3C-IC9
DI	WET WELL HIGH HIGH FLOAT	SLOT 3, CH 3	3C-IC9
DI	WET WELL OVER FLOW FLOAT	SLOT 3, CH 4	3C-IC9
DI	SPARE	SLOT 3, CH 5	3C-IC9
DI	SPARE	SLOT 3, CH 6	3C-IC9
DI	SPARE	SLOT 3, CH 7	3C-IC9
DI	PUMP 2 LEAK ALARM	SLOT 3, CH 8	3C-IC10
DI	PUMP 2 OVER TEMP	SLOT 3, CH 9	3C-IC10
DI	PUMP 2 HOA IN AUTO	SLOT 3, CH 10	3C-IC10
DI	PUMP 2 RUNNING	SLOT 3, CH 11	3C-IC10
DI	PUMP 2 FAULT	SLOT 3, CH 12	3C-IC10
DI	SPARE	SLOT 3, CH 13	3C-IC10
DI	SPARE	SLOT 3, CH 14	3C-IC10
DI	SPARE	SLOT 3, CH 15	3C-IC10
DO	PUMP 1 RUN COMMAND	SLOT 4, CH 0	3C-IC11
DO	PUMP 1 RESET COMMAND	SLOT 4, CH 1	3C-IC11
DO	PUMP 2 RUN COMMAND	SLOT 4, CH 2	3C-IC11
DO	PUMP 2 RESET COMMAND	SLOT 4, CH 3	3C-IC11
DO	SPARE	SLOT 4, CH 4	3C-IC11
DO	SPARE	SLOT 4, CH 5	3C-IC11
DO	SPARE	SLOT 4, CH 6	3C-IC11
DO	SPARE	SLOT 4, CH 7	3C-IC11
DO	ALARM 1 TO TELEMETRY PLC	SLOT 4, CH 8	3C-IC12
DO	ALARM 2 TO TELEMETRY PLC	SLOT 4, CH 9	3C-IC12
DO	ALARM 3 TO TELEMETRY PLC	SLOT 4, CH 10	3C-IC12
DO	ALARM 4 TO TELEMETRY PLC	SLOT 4, CH 11	3C-IC12
DO	ALARM 5 TO TELEMETRY PLC	SLOT 4, CH 12	3C-IC12
DO	ALARM 6 TO TELEMETRY PLC	SLOT 4, CH 13	3C-IC12
DO	ALARM 7 TO TELEMETRY PLC	SLOT 4, CH 14	3C-IC12
DO	ALARM 8 TO TELEMETRY PLC	SLOT 4, CH 15	3C-IC12

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC2 125 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — DEC. 17, 2004 — CARL M. SIEBEN — SIGNATURE — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

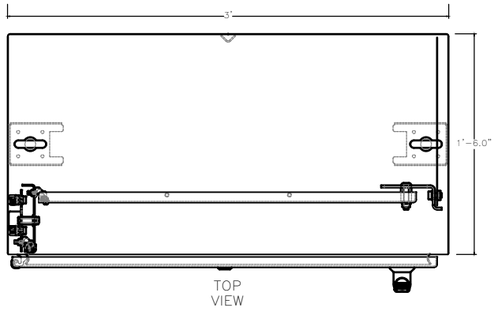
82ND DR PUMP STATION
IO LIST

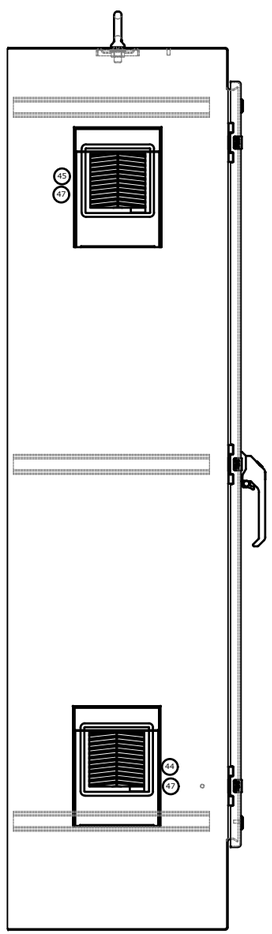
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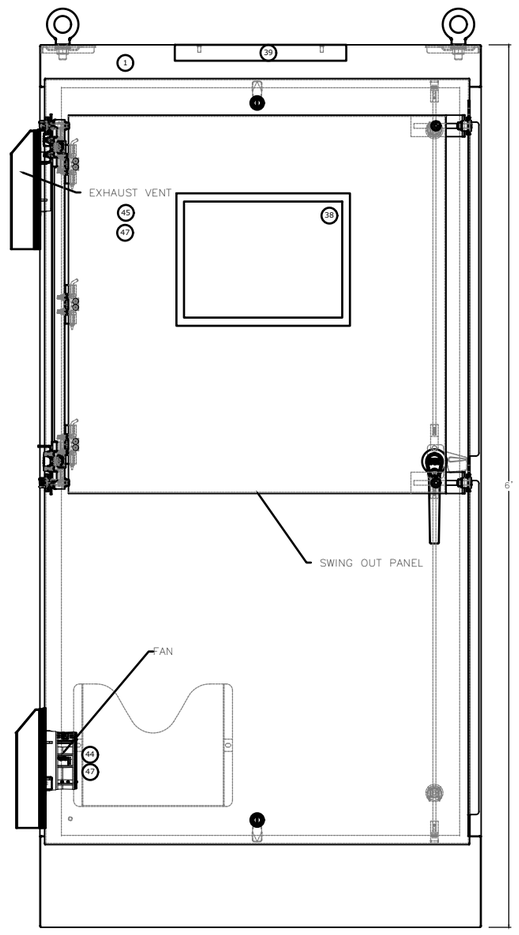
CLACKAMAS WATER ENVIRONMENT SERVICES

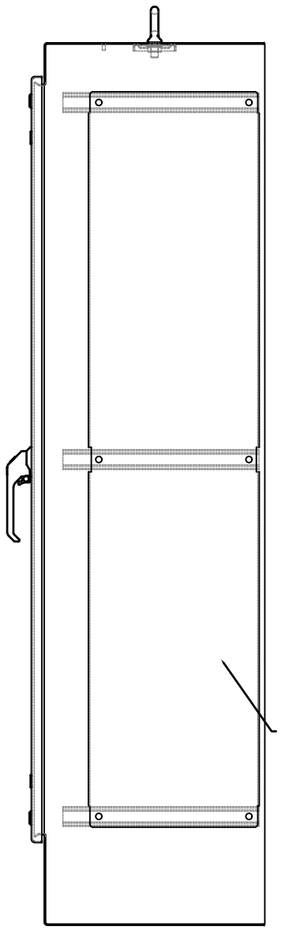
PROJECT: 19-2679 DATE: MAY 2025

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ITEM	QTY	BRAND	PART NUMBER	DESCRIPTION
1	1	SAGINAW	SCE-72EL3618FS	NEMA 4X ENCLOSURE, STAINLESS, 72" BY 36" BY 18"
2	1	SAGINAW	SCE-72P36F1	BACK PANEL, 60" BY 32"
3	1	SAGINAW	SCE-72SMP14	SIDE PANEL, 60" BY 14"
4	1	SAGINAW	SCE-72SP36F4	SWING OUT HALF PANEL, 30" BY 30"
5	1	SAGINAW	SCE-DS36SS	PANEL DRIP SHIELD, STAINLESS
6	1	NTRON	108TX	8 PORT INDUSTRIAL ETHERNET SWITCH
7	8	ALLEN BRADLEY	1492-JG4	GROUND TERMINAL
8	1	ALTECH	1DU15L	MAIN CIRCUIT BREAKER, 15A
9	15	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK
10	35	ALLEN BRADLEY	1492-WFB424	FUSED TERMINAL, 24VDC, INDICATOR
11	6	ALLEN BRADLEY	1492-WFB4250	FUSED TERMINAL, 120VAC, INDICATOR
12	0	ALLEN BRADLEY	1492-WFB4	FUSED TERMINAL, NO INDICATOR
13	AR	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER
14	AR	ALLEN BRADLEY	1492-ERL35	J SCREWLESS END STOP
15	1	SIEMENS	6ES7511-1AK02-0AB0	S7-1500 CPU
16	1	SIEMENS	6ES7954-8LC02-0AA0	MEMORY CARD
17	1	SIEMENS	6ES7590-1AC40-0AA0	PLC MOUNTING RAIL
18	2	SIEMENS	6ES7521-1BH00-0AB0	DIGITAL INPUT MODULE, 16 PT, 24VDC
19	1	SIEMENS	6ES7531-7NF00-0AB0	ANALOG INPUT MODULE, 8 PT, ISOLATED, I/V
20	1	SIEMENS	6ES7522-1BH01-0AB0	DIGITAL OUTPUT MODULE, 16 PT, 24VDC
21	0	SIEMENS	6ES7532-5HD00-0AB0	ANALOG OUTPUT MODULE, 4 PT, I/V
22	3	SIEMENS	6ES7921-5AB20-0AA0	DIGITAL IO MODULE FRONT CONNECTOR
23	1	SIEMENS	6ES7921-5AK20-0AA0	ANALOG IO MODULE FRONT CONNECTOR
24	4	SIEMENS	6ES7924-0AA20-0AA0	DI TERMINATION MODULE
25	2	SIEMENS	6ES7924-0BD20-0BA0	DO 24VDC RELAY TERMINATION MODULE, LED
27	4	SIEMENS	6ES7924-0CC20-0AA0	AI TERMINATION MODULE
28	4	SIEMENS	6ES7923-0BB00-0DB0	CABLE, 16 PIN IDC, SHIELD, 1M FOR ANALOG
29	1	PHOENIX	5600462	DUPLEX OUTLET FOR UPS
30	6	SIEMENS	6ES7923-0BB50-0CB0	CABLE, 16 PIN IDC, 1.5M FOR DIGITAL MODULE
31	3	ALLEN-BRADLEY	700-HN-101	RELAY SOCKET
32	1	ALLEN-BRADLEY	700-HA33A1	RELAY, 120VAC COIL, 3 POLE
33	2	ALLEN-BRADLEY	700-HA33A24	RELAY, 24VDC COIL, 3 POLE
34	2	ALLEN-BRADLEY	700-FSM7UU23	TIMING RELAY
35	3	TURCK	IM1-121EX-R	INTRINSIC BARRIER, DISCRETE SIGNAL
36	2	TURCK	IM33-11EX-HI	INTRINSIC BARRIER, ANALOG SIGNAL
37	1	CUTLER HAMMER	GBK10	GROUND BAR
38	1	EZ AUTOMATION	EZ3-T10C-E	10" TOUCH SCREEH HMI, 800X600 RES
39	1	SAGINAW	SCE-SLMS	PANEL LIGHT, 120VAC LED, MOTION ACTIVATED
40	1	SAGINAW	SCE-LSA	DOOR SWITCH
41	1	SOLA	SDN2X20RED	24VDC REDUNDANCY MODULE
42	1	SOLA	SDU-10-24B	DC UPS POWER MODULE, 10A 24VDC
43	1	SOLA	SDU-24-BATEM	DC UPS BATTERY MODULE
44	1	SAGINAW	SCE-N12FA44	FILTER FAN, 120VAC
45	1	SAGINAW	SCE-N12FGA44	EXHAUST VENT
46	1	STEGO	01141.9-00	THERMOSTAT
47	2	SAGINAW	SCE-RH4N4XSS	FAN/VENT RAIN HOOD, STAINLESS STEEL
48	1	SHOP SUPPLY	UL LABEL	UL INDUSTRIAL LABEL
49	AR	SHOP SUPPLY	ENGRAVE PLAS NP	PLASTIC NAME PLATES
50	AR	SHOP SUPPLY		35 mm DIN RAIL
51	AR	SHOP SUPPLY		WIRE DUCT
52	AR	SHOP SUPPLY		WIRE DUCT COVER, WHITE
53	2	SOLA	SDN-10-24-100C	P/S 10A 24VDC 115/230

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SHEET 3C-IC3 126 of 184

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

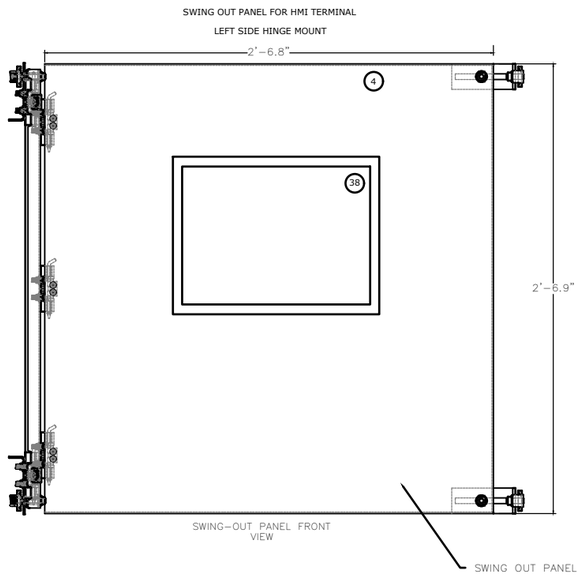
82ND DR PUMP STATION
PANEL EXTERIOR LAYOUT

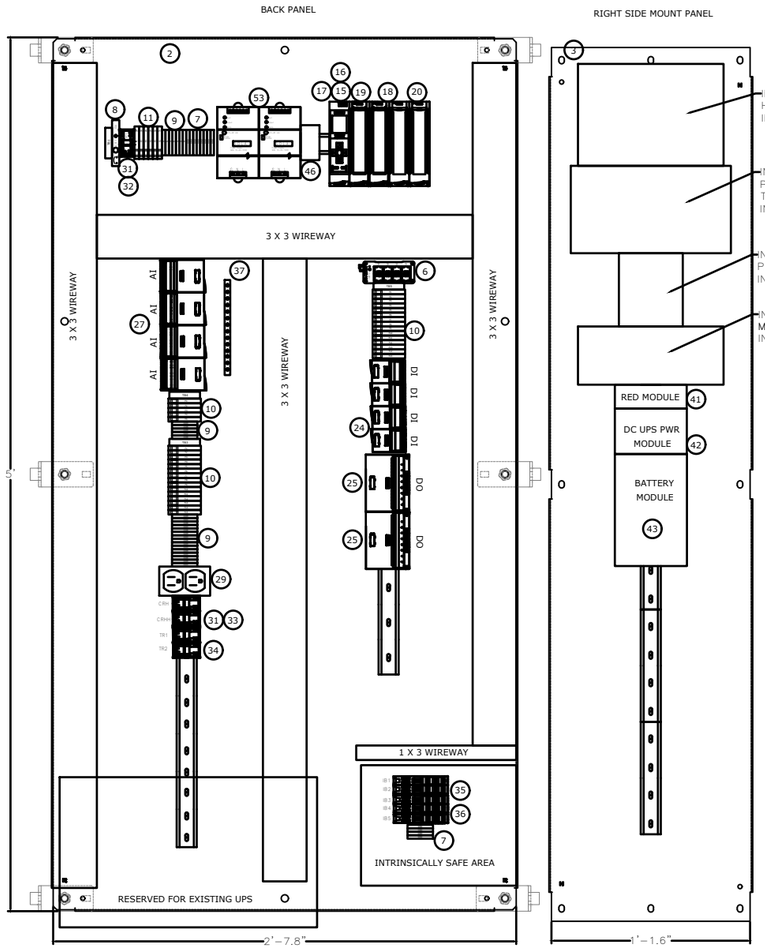
consor

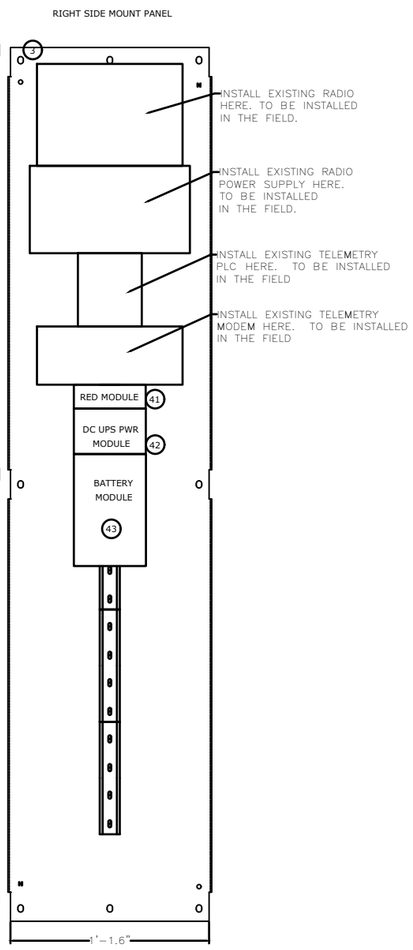
CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

C:\AutoCAD Projects\V255 WES Pump Station Design\82ND\82ND-LO-1.dwg 3C-IC3 5/5/2025 10:48 AM PEI 24.0s (LMS Tech)







ITEM	QTY	BRAND	PART NUMBER	DESCRIPTION
1	1	SAGINAW	SCE-72EL3618FS	NEMA 4X ENCLOSURE, STAINLESS, 72" BY 36" BY 18"
2	1	SAGINAW	SCE-72P36F1	BACK PANEL, 60" BY 32"
3	1	SAGINAW	SCE-72SMP14	SIDE PANEL, 60" BY 14"
4	1	SAGINAW	SCE-72SP36F4	SWING OUT HALF PANEL, 30" BY 30"
5	1	SAGINAW	SCE-DS36SS	PANEL DRIP SHIELD, STAINLESS
6	1	NTRON	108TX	8 PORT INDUSTRIAL ETHERNET SWITCH
7	8	ALLEN BRADLEY	1492-JG4	GROUND TERMINAL
8	1	ALTECH	1DU15L	MAIN CIRCUIT BREAKER, 15A
9	15	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK
10	35	ALLEN BRADLEY	1492-WFB424	FUSED TERMINAL, 24VDC, INDICATOR
11	6	ALLEN BRADLEY	1492-WFB4250	FUSED TERMINAL, 120VAC, INDICATOR
12	0	ALLEN BRADLEY	1492-WFB4	FUSED TERMINAL, NO INDICATOR
13	AR	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER
14	AR	ALLEN BRADLEY	1492-ERL35	J SCREWLESS END STOP
15	1	SIEMENS	6ES7511-1AK02-0AB0	S7-1500 CPU
16	1	SIEMENS	6ES7954-8LC02-0AA0	MEMORY CARD
17	1	SIEMENS	6ES7590-1AC40-0AA0	PLC MOUNTING RAIL
18	2	SIEMENS	6ES7521-1BH00-0AB0	DIGITAL INPUT MODULE, 16 PT, 24VDC
19	1	SIEMENS	6ES7531-7NF00-0AB0	ANALOG INPUT MODULE, 8 PT, ISOLATED, I/V
20	1	SIEMENS	6ES7522-1BH01-0AB0	DIGITAL OUTPUT MODULE, 16 PT, 24VDC
21	0	SIEMENS	6ES7532-5HD00-0AB0	ANALOG OUTPUT MODULE, 4 PT, I/V
22	3	SIEMENS	6ES7921-5AB20-0AA0	DIGITAL IO MODULE FRONT CONNECTOR
23	1	SIEMENS	6ES7921-5AK20-0AA0	ANALOG IO MODULE FRONT CONNECTOR
24	4	SIEMENS	6ES7924-0AA20-0AA0	DI TERMINATION MODULE
25	2	SIEMENS	6ES7924-0BD20-0BA0	DO 24VDC RELAY TERMINATION MODULE, LED
27	4	SIEMENS	6ES7924-0CC20-0AA0	AI TERMINATION MODULE
28	4	SIEMENS	6ES7923-0BB00-0DB0	CABLE, 16 PIN IDC, SHIELD, 1M FOR ANALOG
29	1	PHOENIX	5600462	DUPLEX OUTLET FOR UPS
30	6	SIEMENS	6ES7923-0BB50-0CB0	CABLE, 16 PIN IDC, 1.5M FOR DIGITAL MODULE
31	3	ALLEN-BRADLEY	700-HN-101	RELAY SOCKET
32	1	ALLEN-BRADLEY	700-HA33A1	RELAY, 120VAC COIL, 3 POLE
33	2	ALLEN-BRADLEY	700-HA33A24	RELAY, 24VDC COIL, 3 POLE
34	2	ALLEN-BRADLEY	700-FSM7UU23	TIMING RELAY
35	3	TURCK	IM1-121EX-R	INTRINSIC BARRIER, DISCRETE SIGNAL
36	2	TURCK	IM33-11EX-HI	INTRINSIC BARRIER, ANALOG SIGNAL
37	1	CUTLER HAMMER	GBK10	GROUND BAR
38	1	EZ AUTOMATION	EZ3-T10C-E	10" TOUCH SCREEH HMI, 800X600 RES
39	1	SAGINAW	SCE-SLMS	PANEL LIGHT, 120VAC LED, MOTION ACTIVATED
40	1	SAGINAW	SCE-LSA	DOOR SWITCH
41	1	SOLA	SDN2X20RED	24VDC REDUNDANCY MODULE
42	1	SOLA	SDU-10-248	DC UPS POWER MODULE, 10A 24VDC
43	1	SOLA	SDU-24-BATEM	DC UPS BATTERY MODULE
44	1	SAGINAW	SCE-N12FA44	FILTER FAN, 120VAC
45	1	SAGINAW	SCE-N12FGA44	EXHAUST VENT
46	1	STEGO	01141.9-00	THERMOSTAT
47	2	SAGINAW	SCE-RH4N4XSS	FAN/VENT RAIN HOOD, STAINLESS STEEL
48	1	SHOP SUPPLY	UL LABEL	UL INDUSTRIAL LABEL
49	AR	SHOP SUPPLY	ENGRAVE PLAS NP	PLASTIC NAME PLATES
50	AR	SHOP SUPPLY		35 mm DIN RAIL
51	AR	SHOP SUPPLY		WIRE DUCT
52	AR	SHOP SUPPLY		WIRE DUCT COVER, WHITE
53	2	SOLA	SDN-10-24-100C	P/S 10A 24VDC 115/230

SHEET NOTES:

1. INSTALL BARRIER TO SEPARATE INTRINSICALLY SAFE AREA FROM OTHER PANEL COMPONENTS.

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC4
127 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT: HORIZ:
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

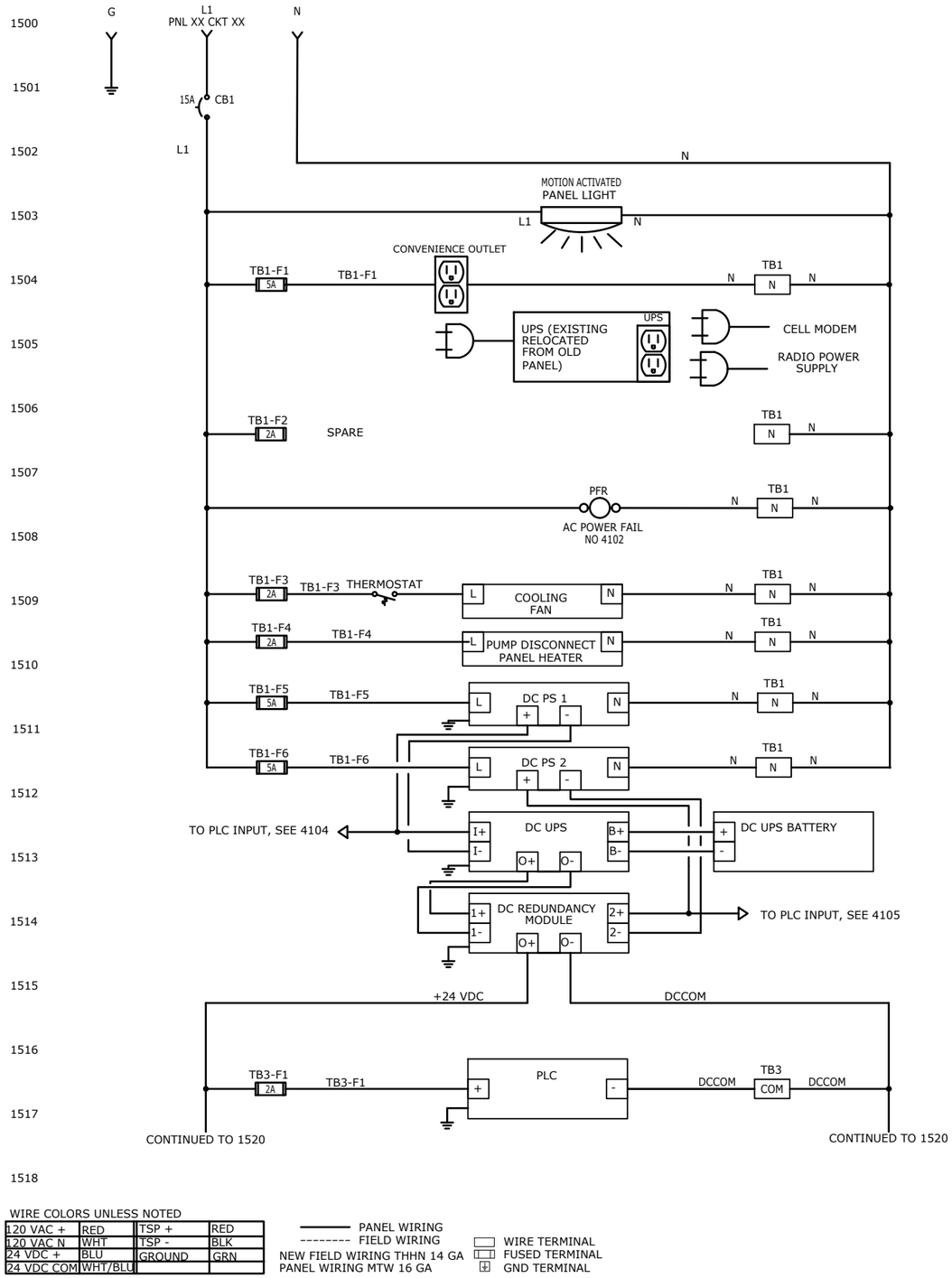
82ND DR PUMP STATION
PANEL INTERIOR LAYOUT

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

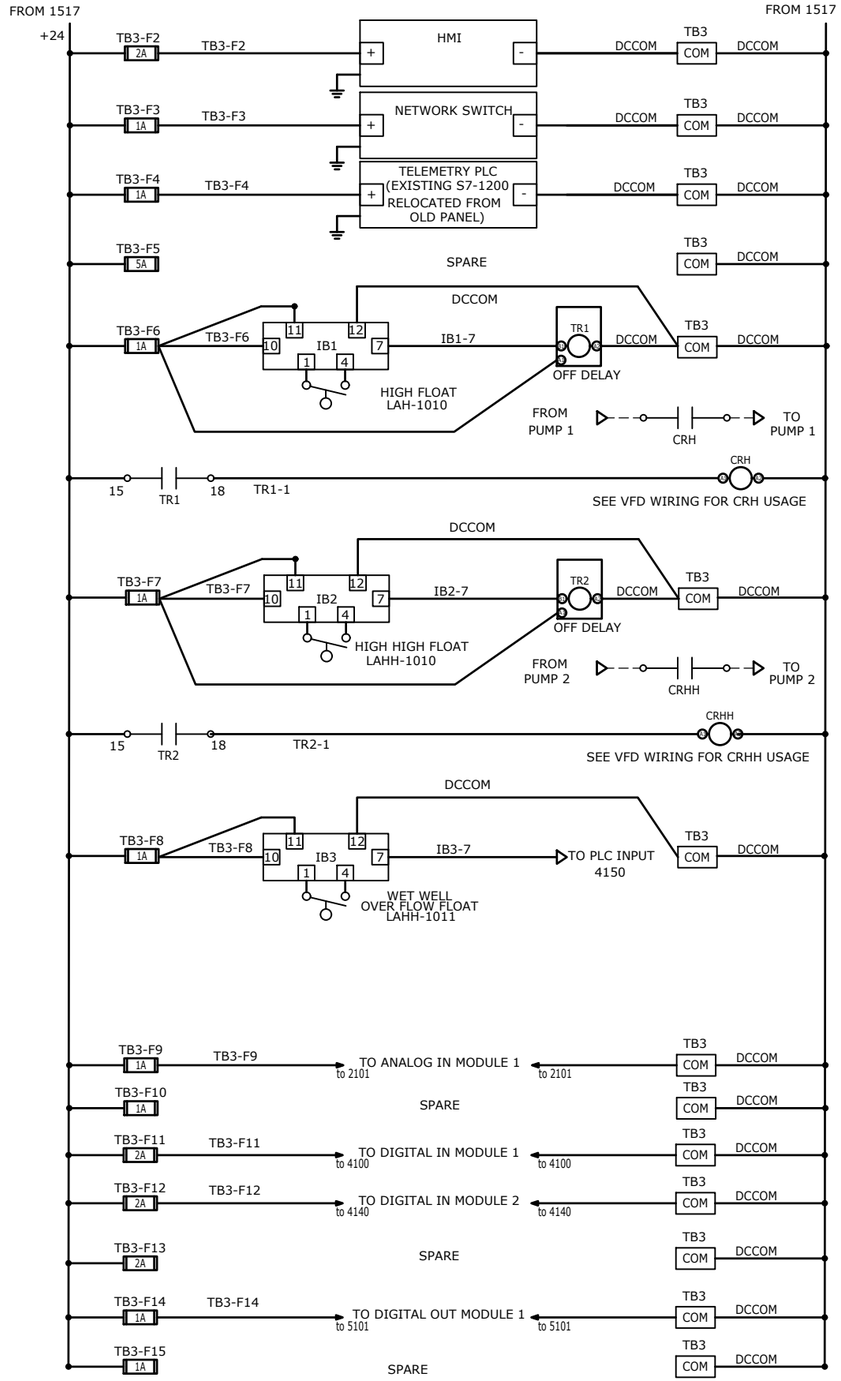
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WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL



PORTLAND Engineering Inc.

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DESIGNED: JCH
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CHECKED: CMS
APPROVED:
SHEET 3C-IC5 128 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JULY 17, 2012 — CARL M. SIEBEN
EXPIRES: 06/30/2026

SCALE
VERT.:
HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

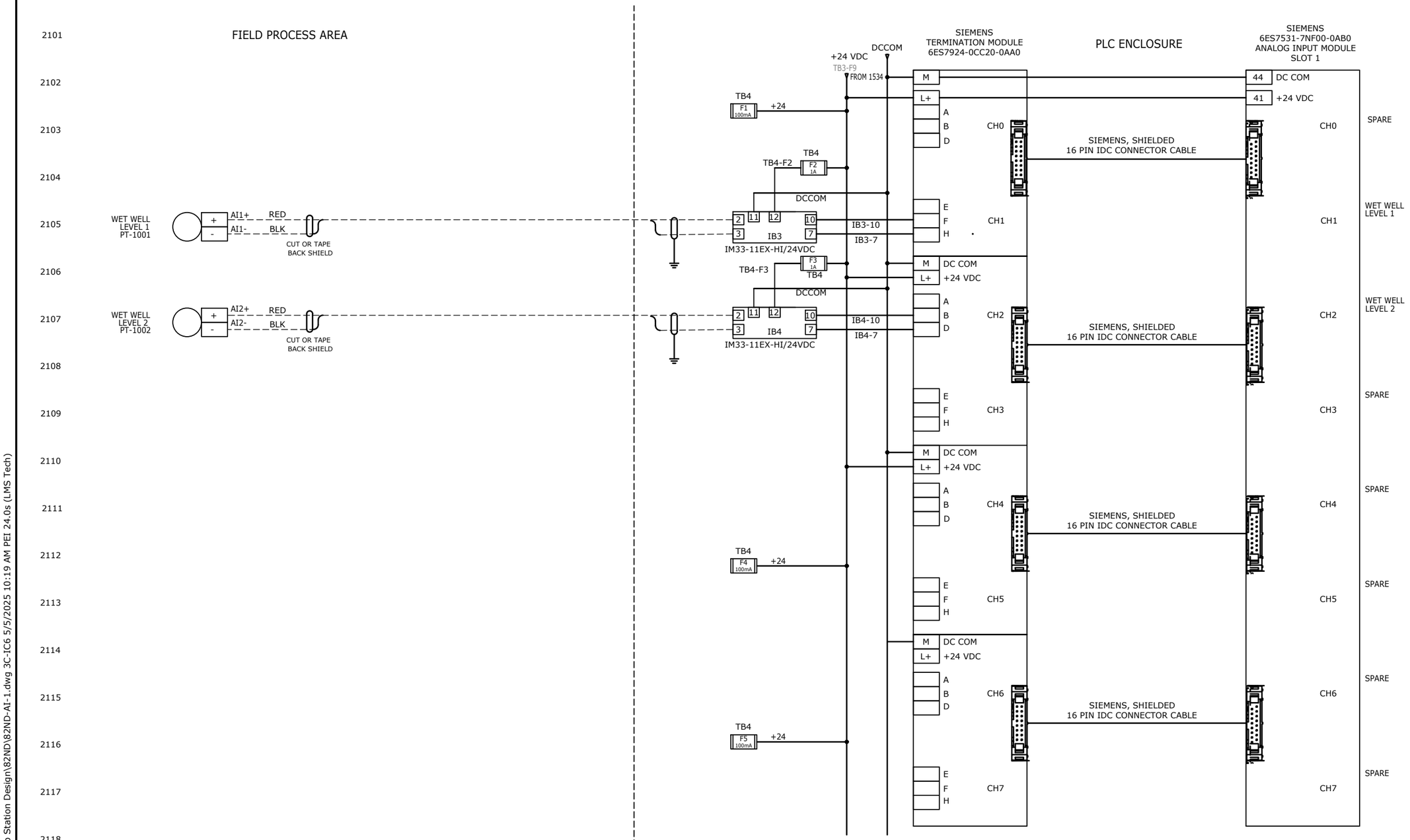
82ND DR PUMP STATION
POWER DISTRIBUTION

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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C:\AutoCAD Projects\V255 WES Pump Station Design\82ND\82ND-AI-1.dwg 3C-IC6 5/5/2025 10:19 AM PEI 24.0s (LMS Tech)

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

SHEET 3C-IC6
129 of 184

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER
OREGON
JANUARY 17, 2014
CARL M. SIEBEN
EXPIRES: 06/30/2026

SCALE
VERT.:
HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0
1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
ANALOG INPUT

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

FIELD PROCESS AREA

4100
4101
4102
4103
4104
4105
4106
4107
4108
4109
4110
4111
4112
4113
4114
4115
4116
4117

POWER FAIL
PFR

PANEL INTRUSION

MAIN PUMP PANEL INTRUSION

PANEL INT.

PFR
1508

TB5-F1
DI1-3
DI1-4
TB5-F2
DI1-5
TB5-F3
DI1-6
TB5-F4
DI1-7

+24 VDC
TB3-F11
FROM 1535

DCCOM

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

M			
L+			
0	IN- 0	CH0	POWER FAIL STATUS
1	IN- 1	CH1	POWER SUPPLY 1 STATUS
2	IN- 2	CH2	POWER SUPPLY 2 STATUS
3	IN- 3	CH3	PANEL DOOR SWITCH
4	IN- 4	CH4	MAIN PUMP PANEL INTRUS
5	IN- 5	CH5	SPARE
6	IN- 6	CH6	SPARE
7	IN- 7	CH7	SPARE

FROM PS1, SEE 1513
FROM PS2, SEE 1514

TB5-F1 1A
TB5-F2 1A
TB5-F3 1A
TB5-F4 1A

CONTINUED ON NEXT SHEET

SIEMENS
16 PIN IDC CONNECTOR CABLE

SIEMENS
6ES7522-1BH01-0AB0
DIGITAL INPUT MODULE
SLOT 3

20	DC COM	
19	+24 VDC	
	CH0	POWER FAIL STATUS
	CH1	POWER SUPPLY 1 STATUS
	CH2	POWER SUPPLY 2 STATUS
	CH3	PANEL DOOR SWITCH
	CH4	MAIN PUMP PANEL INTRUS
	CH5	SPARE
	CH6	SPARE
	CH7	SPARE

CONTINUED ON NEXT SHEET

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

PANEL WIRING
FIELD WIRING
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

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DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC7 130 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JASON C. WHIPPLE — DEC. 17, 2024 — CARL M. SIEBEN
EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
DIGITAL INPUT - 1

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

DATE: MAY 2025
PROJECT: 19-2679

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FIELD PROCESS AREA

CONTINUED FROM PREV SHEET

CONTINUED ON PREVIOUS SHEET

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

+24 VDC

DC COM

TB5-F6

TB5-F5
1A

PUMP 1 MCC

4120							
4121				M	DC COM		
4122	PUMP 1 LEAK ALARM YA-1111C	DI1-9		0	IN- 0	CH0	CH8 PUMP 1 LEAK ALARM
4123							
4124	PUMP 1 OVERTEMP ALARM YA-1111B	DI1-10		1	IN- 1	CH1	CH9 PUMP 1 OVER TEMP ALARM
4125							
4126	PUMP 1 HOA IN AUTO YS-1111A	DI1-11		2	IN- 2	CH2	CH10 PUMP 1 HOA IN AUTO
4127							
4128	PUMP 1 RUNNING YS-1111B	DI1-12		3	IN- 3	CH3	CH11 PUMP 1 RUNNING
4129							
4130	PUMP 1 FAULT YA-1111A	DI1-13		4	IN- 4	CH4	CH12 PUMP 1 FAULT ALARM
4131			TB5-F6 1A				
4132				5	IN- 5	CH5	DI1-1 CH13 SPARE
4133			TB5-F7 1A				DI1-2
4134				6	IN- 6	CH6	CH14 SPARE
4135							
4136				7	IN- 7	CH7	CH15 SPARE
4137							

SIEMENS
16 PIN IDC CONNECTOR CABLE

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

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NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC8
131 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
DEC. 17, 2024
CARL M. SIEBEN
EXPIRES: 06/30/2026

SCALE
VERT:
HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
DIGITAL INPUT - 2

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

FIELD PROCESS AREA

4140
4141
4142
4143
4144
4145
4146
4147
4148
4149
4150
4151
4152
4153
4154
4155
4156
4157

WET WELL
HIGH LEVEL FLOAT
LSH-1010

WET WELL
HIGH HIGH LEVEL FLOAT
LSHH-1010

+24 VDC
TB3-F12
FROM 1536

DCCOM

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

SIEMENS
6ES7522-1BH01-0AB0
DIGITAL INPUT MODULE
SLOT 4

TB5-F8
1A

TB5-F9
1A

TB5-F10
1A

TB5-F11
1A

M			20	DC COM
L+			19	+24 VDC
0	IN- 0	CH0	CH0	SPARE
1	IN- 1	CH1	CH1	SPARE
2	IN- 2	CH2	CH2	WET WELL HIGH FLOAT
3	IN- 3	CH3	CH3	WET WELL HIGH HIGH FLOAT
4	IN- 4	CH4	CH4	WET WELL OVER FLOW FLOAT
5	IN- 5	CH5	CH5	SPARE
6	IN- 6	CH6	CH6	SPARE
7	IN- 7	CH7	CH7	SPARE

CRH
1528
DI2-2

CRHH
1530
DI2-3

IB3-7
FROM 1531

SIEMENS
16 PIN IDC CONNECTOR CABLE

CONTINUED ON NEXT SHEET

CONTINUED ON NEXT SHEET

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

PANEL WIRING
FIELD WIRING
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

SHEET 3C-IC9 132 of 184
BY
REVISION
NO. DATE
DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER
OREGON
DEC. 17, 2024
CARL M. SIMPSON
EXPIRES: 06/30/2026

SCALE
VERT:
HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
DIGITAL INPUT - 3

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

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FIELD PROCESS AREA

CONTINUED FROM PREV SHEET

CONTINUED ON PREVIOUS SHEET

PUMP 2 MCC

TB5-F12

TB5-F12 1A

+24 VDC

DC COM

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

PUMP 2 LEAK ALARM YA-1111C	DI2-8	M	DC COM		CH8	PUMP 2 LEAK ALARM
		L+	+24 VDC			
		0	IN- 0	CH0		
PUMP 2 OVERTEMP ALARM YA-1111B	DI2-9	1	IN- 1	CH1	CH9	PUMP 2 OVER TEMP ALARM
PUMP 2 HOA IN AUTO YS-1111A	DI2-10	2	IN- 2	CH2	CH10	PUMP 2 HOA IN AUTO
PUMP 2 RUNNING YS-1111B	DI2-11	3	IN- 3	CH3	CH11	PUMP 2 RUNNING
PUMP 2 FAULT YA-1111A	DI2-12	4	IN- 4	CH4	CH12	PUMP 2 FAULT ALARM
	TB5-F13 1A	5	IN- 5	CH5	CH13	SPARE
	TB5-F14 1A	6	IN- 6	CH6	CH14	SPARE
	TB5-F15 1A	7	IN- 7	CH7	CH15	SPARE

SIEMENS
16 PIN IDC CONNECTOR CABLE

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

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DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC10 133 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JAMES C. HAPPE — DEC. 17, 2024 — CARL M. SIMS — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:

NOTICE
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0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

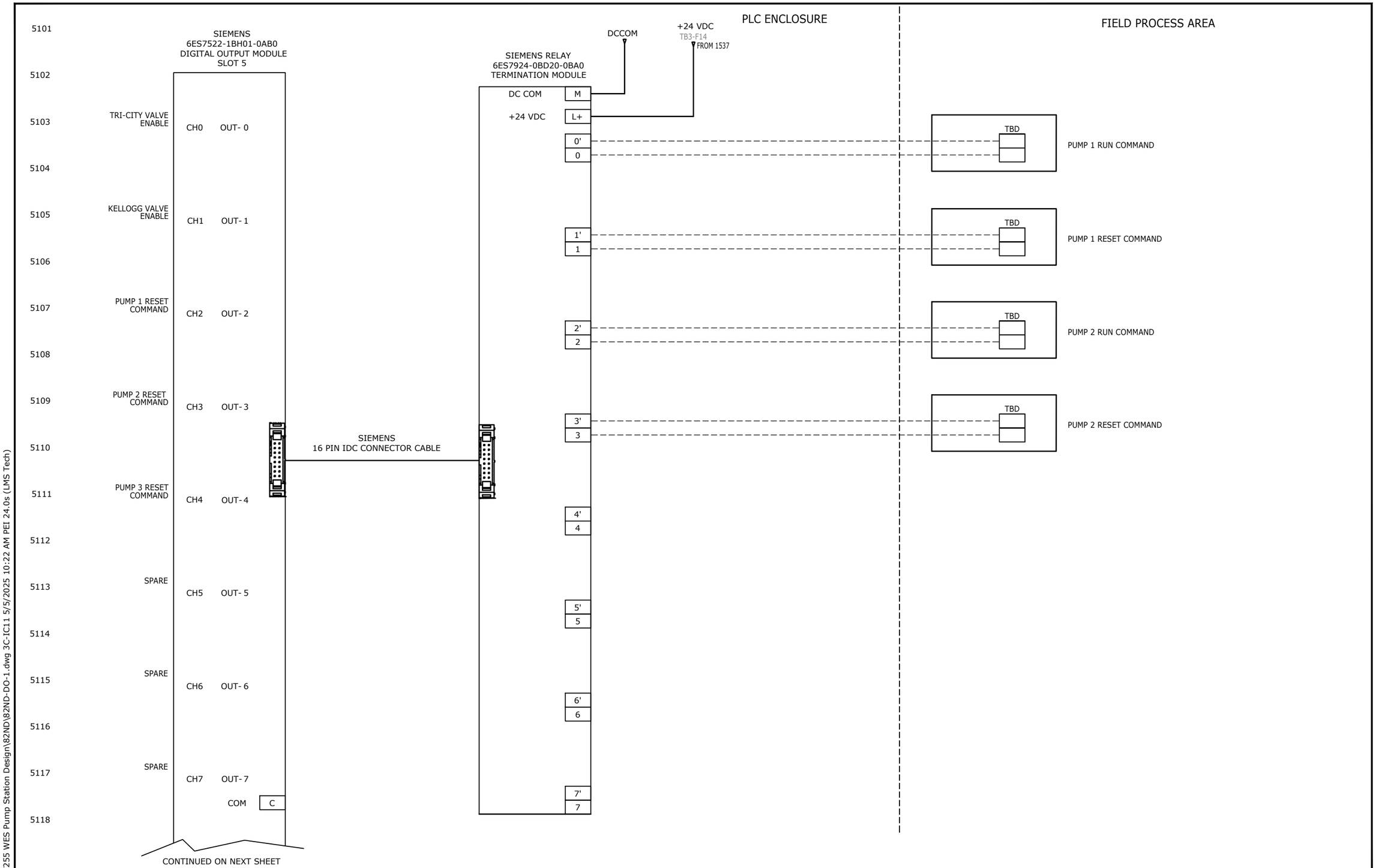
82ND DR PUMP STATION
DIGITAL INPUT - 4

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CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC11 134 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JAMES C. KNAPP — DEC. 17, 2024 — CARL M. SIEBEN
EXPIRES: 06/30/2026

SCALE VERT: HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

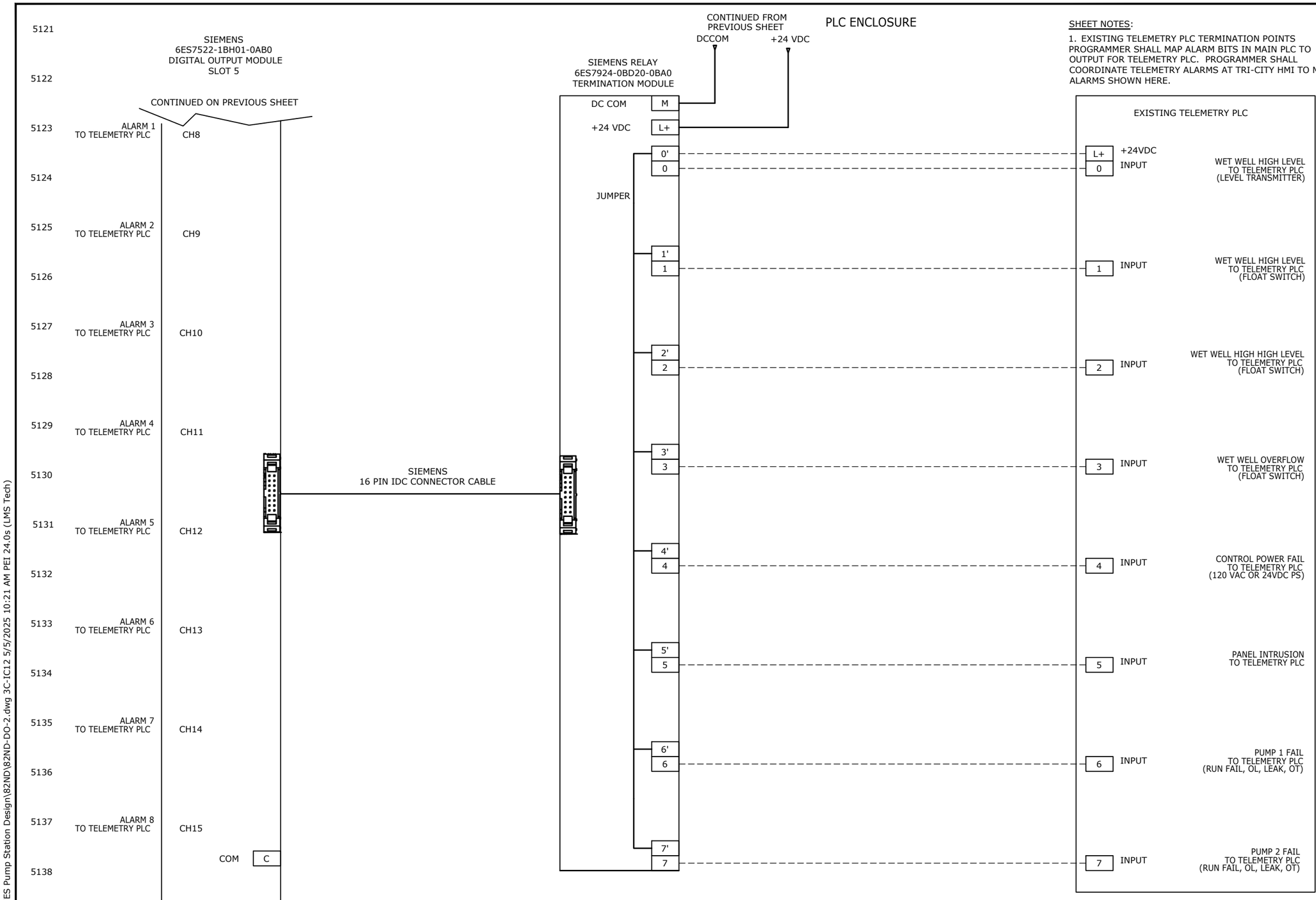
82ND DR PUMP STATION
DIGITAL OUTPUT - 1

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

C:\AutoCAD Projects\V255 WES Pump Station Design\82ND\82ND-DO-1.dwg 3C-1C11 5/5/2025 10:22 AM PEI 24.0s (LMS Tech)



SHEET NOTES:

1. EXISTING TELEMETRY PLC TERMINATION POINTS PROGRAMMER SHALL MAP ALARM BITS IN MAIN PLC TO OUTPUT FOR TELEMETRY PLC. PROGRAMMER SHALL COORDINATE TELEMETRY ALARMS AT TRI-CITY HMI TO MATCH ALARMS SHOWN HERE.

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC12 135 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JAMES C. HAWPE — DEC. 17, 2024 — CARL M. SIEBEN
EXPIRES: 06/30/2026

SCALE VERT.: HORIZ:
NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
DIGITAL OUTPUT - 2

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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SHEET NOTES:

1. INTRINSICALLY SAFE DETAIL APPLIES TO ANALOG INPUT ON SHEET 3C-IC6. APPLIES TO FLOAT CONTROLS ON SHEET 1A-IC5. CERTIFICATION: TURCK IECEx TUN 06.0007X

HAZARDOUS AREA
CLASS 1, DIVISION 1, GROUP D

SAFE AREA

WETWELL LEVEL 1
PT-1004

BLU
WHT

TB4-F2 DCCOM

IB4
IM33-11EX-HI/24VDC

PLC ANALOG INPUT MODULE 1
IB3-7 F
IB3-10 H

WETWELL LEVEL 2
PT-1005

BLU
WHT

TB4-F3 DCCOM

IB5
IM33-11EX-HI/24VDC

PLC ANALOG INPUT MODULE 2
IB4-7 B
IB4-10 D

HIGH FLOAT
LSH-1010

TB3-F6
TB3-F6 1A +24VDC
TR1
TB3 COM
DCCOM
DCCOM

IB1
IM1-121EX-R/24VDC

HIGH HIGH FLOAT
LSHH-1010

TB3-F7
TB3-F7 1A +24VDC
TR2
TB3 COM
DCCOM
DCCOM

IB2
IM1-121EX-R/24VDC

WET WELL OVERFLOW
LSHH-1011

TB3-F8
TB3-F8 1A +24VDC
4150 TO PLC INPUT
TB3 COM
DCCOM
DCCOM

IB3
IM1-121EX-R/24VDC

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC13
136 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
JANUARY 17, 2014
CARL M. SIEBEN
EXPIRES: 06/30/2026

SCALE
VERT.:
HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

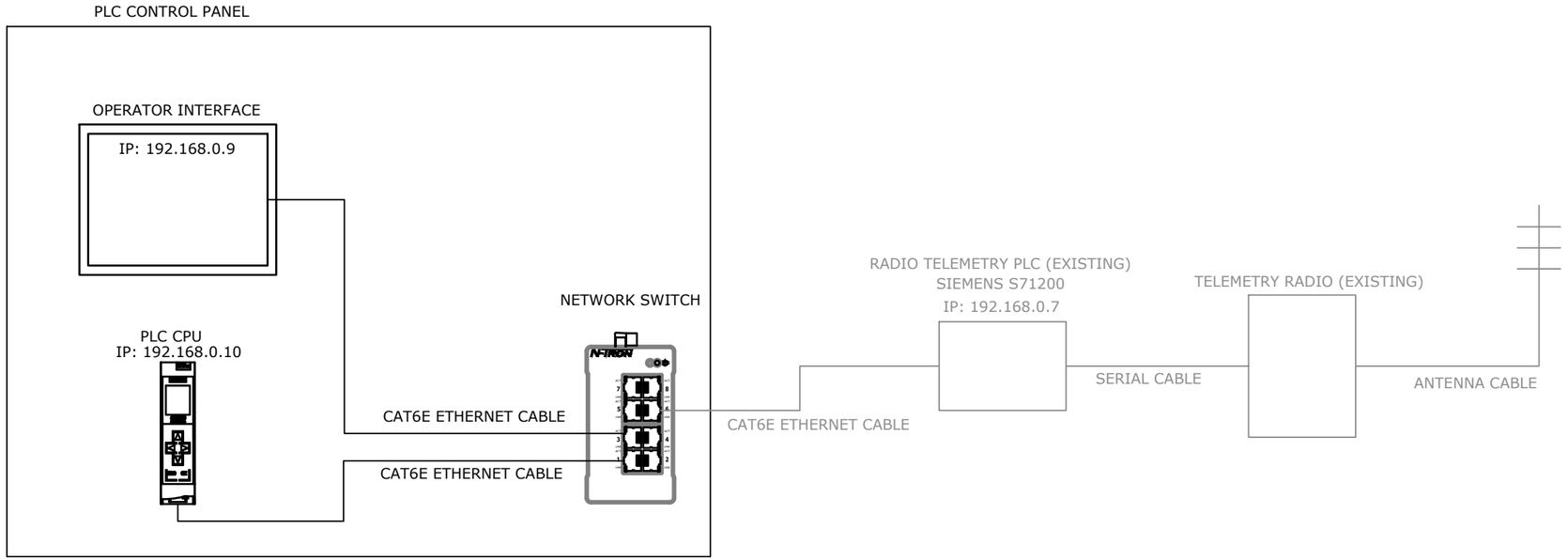
82ND DR PUMP STATION
INTRINSIC SAFETY

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

DATE: MAY 2025
PROJECT: 19-2679

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NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC14 137 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.: NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
NETWORK DETAIL

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

PORTLAND Engineering Inc.



REMOVE EXISTING RADIO AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 3C-IC4 FOR INSTALL LOCATION. PULL BACK EXISTING ANTENNA CABLE AND RE-ROUTE TO NEW CONTROL PANEL AND RE-TERMINATE ON RADIO.

EXISTING TELEMETRY PANEL: REMOVE S7-1200 PLC IN THIS PANEL AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 3C-IC4 FOR INSTALL LOCATION. SALVAGE ENCLOSURE AND REMAINING PARTS AND RETURN TO WATER ENVIRONMENT SERVICES. SEE SHEET 3C-IC12 FOR TELEMETRY PLC INPUT WIRING.

EXISTING TELEMETRY PANEL: REMOVE SERIAL MODEM AND CABLES IN THIS PANEL AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 3C-IC4 FOR INSTALL LOCATION. SALVAGE ENCLOSURE AND REMAINING PARTS AND RETURN TO WATER ENVIRONMENT SERVICES.

EXISTING TELEMETRY PANEL DEMOLITION 1



EXISTING RADIO POWER PANEL: REMOVE RADIO POWER SUPPLY COMPONENTS IN THIS PANEL AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 3C-IC4 FOR INSTALL LOCATION.

EXISTING UPS: REMOVE UPS IN THIS PANEL AND PUT IN BOTTOM OF NEW CONTROL PANEL.

EXISTING RADIO POWER PANEL DEMOLITION DETAIL 2

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3C-IC15
138 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SWAPE — EXPIRES: 06/30/2026

SCALE VERT: HORIZ:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

82ND DR PUMP STATION
INSTALL AND DEMOLITION DETAIL

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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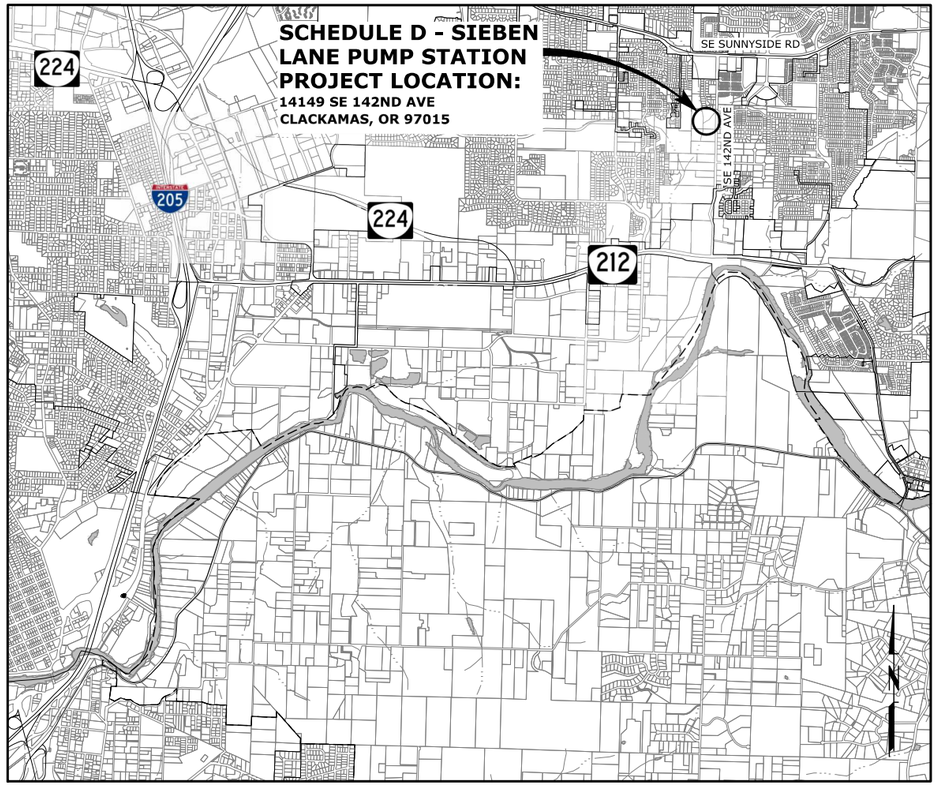
CLACKAMAS
WATER ENVIRONMENT SERVICES

PUMP STATION REHABILITATION AND UPGRADES PROJECT

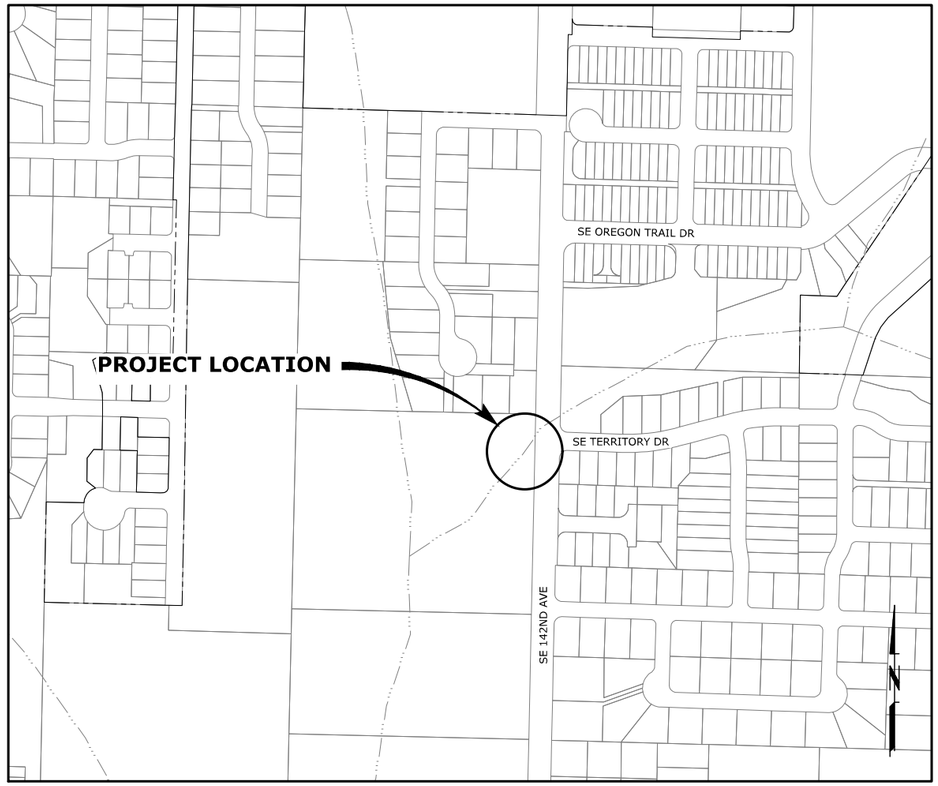
GROUP 3

SCHEDULE D - SIEBEN LANE PUMP STATION

AUGUST 2024



VICINITY MAP
SCALE: 1"=2,000'



LOCATION MAP
SCALE: 1"=200'

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: JCC
CHECKED: EPK
APPROVED: NSL

SHEET 3D-G1
139 of 184

OREGON PROFESSIONAL ENGINEER 98172 Nicholas S. Lafrenz
OREGON LICENSED LANDSCAPE ARCHITECT Nicholas S. Lafrenz
Date:
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
COVER SHEET, LOCATION & VICINITY MAP

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

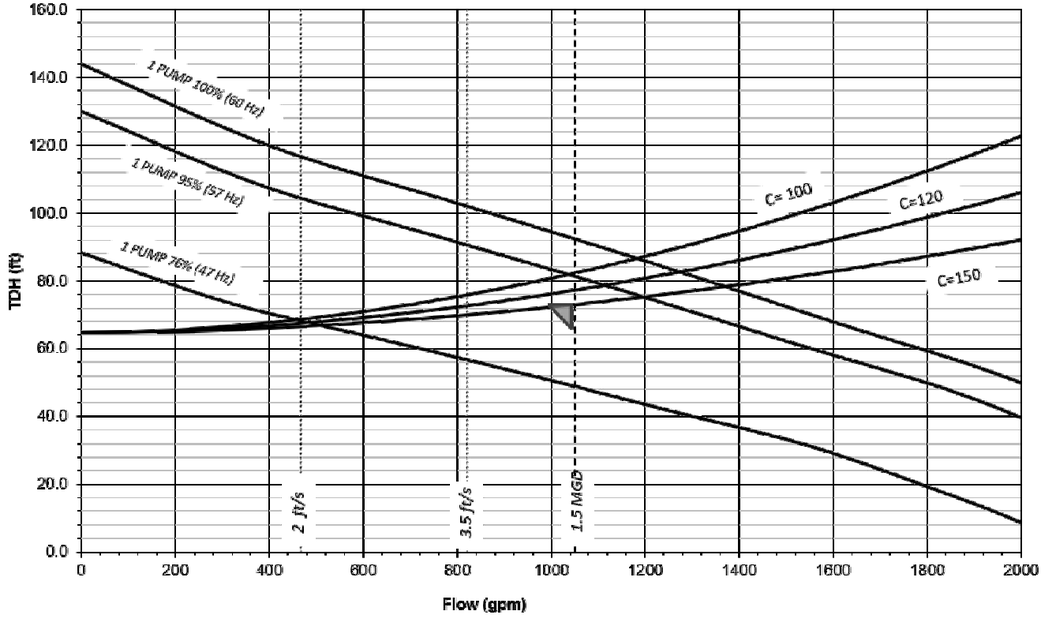
PROJECT: 19-2679
DATE: MAY 2025

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SIEBEN LANE PUMP STATION AND FORCE MAIN DESIGN DATA TABLE

PUMP STATION	
LOCATION	14149 SE 142ND AVENUE CLACKAMAS, OR 97015
TYPE	DUPLEX SUBMERSIBLE SEWAGE PUMP STATION WITH VARIABLE SPEED DRIVES
PUMP STATION FIRM CAPACITY	1,050 GPM AT 83 FEET TDH; ONE PUMP RUNNING
MOTOR HORSEPOWER, HP	45 HP
PUMP STARTS	8.0 STARTS PER HOUR
WET WELL VOLUME	1,920 GALLONS (PUMPS OFF TO LEAD PUMP ON)
LEVEL CONTROL TYPE	SUBMERSIBLE LEVEL TRANSDUCER (PRIMARY & BACKUP), OVERFLOW FLOAT
ALARM TELEMETRY TYPE (EXIST)	RADIO MODEM W/ PLC, CELLULAR BACKUP
STANDBY POWER TYPE	100 KW PERMANENT DIESEL STANDBY GENERATOR WITH AUTOMATIC TRANSFER SWITCH
FUEL TANK CAPACITY (EXIST)	203 GALLONS, 24 HOUR CAPACITY
OVERFLOW POINT	MANHOLE SL-17 APPROXIMATELY 100 FT SW OF PUMP STATION AND TO ADJACENT ROCK CREEK
OVERFLOW ELEVATION	243.50
TIME TO OVERFLOW	6.5 HRS @ 270 GPM (ADWF)
EPA RELIABILITY CLASS	1
FORCE MAIN	
TYPE AND LENGTH	1,180 FEET OF 10" PVC FORCE MAIN
PROFILE DESCRIPTION	CONTINUOUSLY ASCENDING TO THE DISCHARGE MANHOLE
AIR RELEASE VALVES	NONE
AVERAGE FORCE MAIN DETENTION TIME	19 MINUTES @ 270 GPM (ADWF)
DISCHARGE MANHOLE LOCATION	MANHOLE ON SE 142ND AVENUE
SULFIDE CONTROL SYSTEM	NONE

SIEBEN LANE PUMP STATION SYSTEM HEAD AND PUMP CURVES



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NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: MBE
CHECKED: EPK
APPROVED: NSL

SHEET 3D-G2 140 of 184

OREGON REGISTERED PROFESSIONAL ENGINEER 98172 Nicholas S. Lafrenz
Nicholas S. Lafrenz - OREGON
Date:
RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
DESIGN DATA TABLE AND SYSTEM CURVE

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

QUALITY ASSURANCE PLAN:

QUALITY ASSURANCE FOR SEISMIC RESISTANCE:

QUALITY ASSURANCE FOR THE STRUCTURE'S MAIN LATERAL FORCE RESISTING SYSTEM SHALL BE PROVIDED BY SPECIAL INSPECTION AND MATERIAL TESTING OF THE FOLLOWING:

SPECIAL INSPECTIONS:

1. SPECIAL INSPECTIONS SHALL CONFORM TO SECTION 1705 OF THE 2021 OSSC, CONTRACT DOCUMENTS AND APPROVED SUBMITTALS. REFER TO SPECIAL INSPECTION AND TESTING TABLES FOR PROJECT REQUIREMENTS.

2. SPECIAL INSPECTIONS AND ASSOCIATED TESTING SHALL BE PERFORMED BY AN APPROVED ACCREDITED INDEPENDENT AGENCY MEETING THE REQUIREMENTS OF ASTM E329 (MATERIALS). THE INSPECTION AND TESTING AGENCY SHALL FURNISH TO THE ENGINEER OF RECORD A COPY OF THEIR SCOPE OF ACCREDITATION. SPECIAL INSPECTORS SHALL BE APPROVED BY THE BUILDING OFFICIAL. WELDING INSPECTORS SHALL BE QUALIFIED PER SECTION 6.1.4.1(1) OF AWS D1.1.

3. THE SPECIAL INSPECTOR SHALL OBSERVE THE INDICATED WORK FOR COMPLIANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS. ALL DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE CONTRACTOR FOR CORRECTION AND NOTED IN THE INSPECTION REPORTS.

4. THE SPECIAL INSPECTOR AND GEOTECHNICAL ENGINEER SHALL FURNISH INSPECTION REPORTS FOR EACH INSPECTION TO THE BUILDING OFFICIAL, STRUCTURAL ENGINEER, ARCHITECT, CONTRACTOR, AND OWNER. THE SPECIAL INSPECTION AGENCY SHALL SUBMIT A FINAL REPORT STATING THAT THE WORK REQUIRING SPECIAL INSPECTION WAS INSPECTED AND IS IN CONFORMANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS AND THAT ALL DISCREPANCIES NOTED IN THE INSPECTION REPORTS HAVE BEEN CORRECTED.

5. QUALITY ASSURANCE (QA) IS REQURIED FOR STRUCTURAL STEEL ITEMS PER AISC 360 AND 341 UNLESS SPECIFICALLY NOTED OTHERWISE. QUALITY CONTROL (QC) TO BE PROVIDED BY THE FABRICATOR, ERECTOR OR OTHER RESPONSIBLE CONTRACTOR AS APPLICABLE. CONTRACTOR AND SPECIAL INSPECTOR TO DOCUMENT QUALITY CONTROL AS REQUIRED IN AISC 360 SECTION N3 AND AISC 341 SECTION J2.

6. INSPECTION TYPES:
   - 6.1. CONTINUOUS : THE FULL-TIME OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK IS BEING PERFORMED.
   - 6.2. PERIODIC : THE PART-TIME OR INTERMITTENT OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK HAS BEEN OR IS BEING PERFORMED AND AT THE COMPLETION OF THE WORK.
   - 6.3. OBSERVE : OBSERVE THESE FUNCTIONS ON A RANDOM, DAILY BASIS. OPERATIONS NEED NOT BE DELAYED PENDING OBSERVATIONS.
   - 6.4. PERFORM : INSPECTIONS SHALL BE PERFORMED PRIOR TO THE FINAL ACCEPTANCE OF THE ITEM.

7. PERFORM INSPECTION PRIOR TO FINAL ACCEPTANCE OF THE ITEM FOR TEN WELDS TO BE MADE BY A GIVEN WELDER, WITH THE WELDER DEMONSTRATING UNDERSTANDING OF REQUIREMENTS AND POSSESSION OF SKILLS AND TOOLS TO VERIFY THESE ITEMS, THE PERFORM DESIGNATION OF THIS TASK SHALL BE REDUCED TO OBSERVE, AND THE WELDER SHALL PERFORM THIS TASK. SHOULD THE INSPECTOR DETERMINE THAT THE WELDER HAS DISCONTINUED PERFORMANCE OF THIS TASK, THE TASK SHALL BE RETURNED TO PERFORM UNTIL SUCH TIME AS THE INSPECTOR HAS RE-ESTABLISHED ADEQUATE ASSURANCE THAT THE WELDER WILL PERFORM THE INSPECTION TASKS LISTED.

8. SPECIAL INSPECTION OF MECHANICAL POST INSTALLED ANCHORS SHALL BE IN STRICT CONFORMANCE WITH THE ICC REPORT AND MANUFACTURER'S INSTALLATION REQUIREMENTS. ANCHOR INSTALLERS SHALL BE QUALIFIED AS REQUIRED BY JURISDICTION REQUIREMENTS.
   - 8.1. INSPECTION REPORTS SHALL IDENTIFY NAMES OF INSTALLERS.
   - 8.2. SPECIAL INSPECTOR SHALL PROVIDE DOCUMENTATION AT THE END OF ANCHOR INSTALLATIONS STATING THAT THE ANCHORS WERE INSPECTED PER APPROVED ANCHOR EVALUATION REPORT.

9. TESTING ABBREVIATIONS:
   - 9.1. NDT - NON-DESTRUCTIVE TESTING
   - 9.2. C.J.P. - COMPLETE JOINT PENETRATION
   - 9.3. MT - MAGNETIC PARTICLE TESTING
   - 9.4. RBS - REDUCED BEAM SECTION

10. DOCUMENT (D): INDICATES CONTRACTOR AND SPECIAL INSPECTOR TO PROVIDE DOCUMENTATION IN ACCORDANCE WITH AISC 341.

QUALITY CONTROL:

STRUCTURAL OBSERVATION REQUIREMENTS:

1. THE OWNER SHALL EMPLOY THE ENGINEER OF RECORD OR AN ALTERNATE OREGON LICENSED PROFESSIONAL ENGINEER, APPROVED BY THE ENGINEER OF RECORD, TO PERFORM STRUCTURAL OBSERVATIONS IN ACCORDANCE WITH SECTION 1704.6 OF THE INTERNATIONAL BUILDING CODE.

2. STRUCTURAL OBSERVATION IS THE VISUAL OBSERVATION OF THE STRUCTURAL SYSTEM BY A REGISTERED DESIGN PROFESSIONAL FOR GENERAL CONFORMANCE TO THE APPROVED CONSTRUCTION DOCUMENTS AT SIGNIFICANT CONSTRUCTION STAGES AND AT COMPLETION OF THE STRUCTURAL SYSTEM. STRUCTURAL OBSERVATION DOES NOT INCLUDE OR WAIVE THE RESPONSIBILITY FOR ANY OTHER INSPECTION CRITERIA, INCLUDING SPECIAL INSPECTION, AS REQUIRED BY THE BUILDING OFFICIAL OR AS INDICATED WITHIN THE INTERNATIONAL BUILDING CODE.

3. DEFICIENCIES SHALL BE REPORTED IN WRITING TO THE OWNER AND THE BUILDING OFFICIAL (AND THE ENGINEER OF RECORD IF AN ALTERNATE ENGINEER IS USED FOR STRUCTURAL OBSERVATION). AT THE CONCLUSION OF THE STRUCTURAL WORK INCLUDED WITHIN THE PERMIT, THE STRUCTURAL OBSERVER SHALL SUBMIT TO THE BUILDING OFFICIAL AND THE OWNER (AND THE ENGINEER OF RECORD IF AN ALTERNATE ENGINEER IS USED FOR STRUCTURAL OBSERVATION) A WRITTEN STATEMENT THAT THE SITE VISITS HAVE BEEN MADE AND IDENTIFY ANY REPORTED DEFICIENCIES WHICH, TO THE BEST OF THE STRUCTURAL OBSERVER'S KNOWLEDGE, HAVE NOT BEEN RESOLVED.

4. THE CONTRACTOR SHALL MAKE AVAILABLE ALL MEANS AND METHODS NECESSARY FOR THE STRUCTURAL OBSERVER TO PERFORM THE REQUIRED STRUCTURAL OBSERVATIONS. IN ADDITION, THE CONTRACTOR SHALL NOTIFY THE OWNER AND STRUCTURAL OBSERVER A MINIMUM OF 48 HOURS BEFORE THE TIME AT WHICH THE SPECIFIED STRUCTURAL OBSERVATIONS MAY BE PERFORMED. IN ADDITION THE CONTRACTOR SHALL UPDATE THE STRUCTURAL OBSERVER OF THE CONSTRUCTION PROGRESS.

5. STRUCTURAL OBSERVATIONS SHALL BE PERFORMED FOR THE FOLLOWING AREAS OF WORK:
   - 5.1. UPON PLACEMENT OF FORM WORK AND REINFORCING OF CONCRETE SLAB

GENERAL - SPECIAL INSPECTIONS

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6)		REMARKS
			CONTINUOUS	PERIODIC	
FABRICATORS	1705.10 1704.2.5				SPECIAL INSPECTION IS REQUIRED FOR STRUCTURAL LOAD-BEARING MEMBERS AND ASSEMBLIES FABRICATED ON THE PREMISES OF A FABRICATOR'S SHOP, SPECIAL INSPECTIONS SHALL BE PERFORMED DURING FABRICATION. PERFORMING SPECIAL INSPECTIONS IS NOT REQUIRED, WHERE FABRICATOR HAS BEEN APPROVED AS AN APPROVED FABRICATOR, PER SECTION 1704.2.5.1.
DEFERRED SUBMITTALS				X	SPECIAL INSPECTION REQUIREMENTS FOR DEFERRED SUBMITTAL ITEMS, INCLUDING REQUIREMENTS FOR DESIGNATED SEISMIC SYSTEMS IN ACCORDANCE WITH OSSC SECTION 1705.12.4 IF APPLICABLE, TO BE SPECIFIED BY THE SYSTEM ENGINEER AND INCLUDED WITH DEFERRED SUBMITAL DOCUMENTS.
SUBMITTALS TO THE BUILDING OFFICIAL	1704.5000			X	CERTIFICATES OF COMPLIANCE, REPORTS OF PRE-CONSTRUCTION TESTS, OR REPORTS OF MATERIAL PROPERTIES SHALL BE SUBMITTED TO THE BUILDING OFFICIAL.
POST INSTALLED MECHANICAL ANCHORS AND ADHESIVE ANCHORS (EXCLUDING CONDITIONS NOTED ABOVE) IN HARDENED CONCRETE				X	

CONCRETE - SPECIAL INSPECTIONS

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6)		REMARKS
			CONTINUOUS	PERIODIC	
GENERAL	"1705.3 1901.6"	ACI 318: 26.13			SPECIAL INSPECTIONS OF CONCRETE SHALL CONFORM TO THE REQUIREMENTS OF SECTION 1705.3 OF THE IBC AND SECTION 26.13 OF ACI 318.
REINFORCING STEEL PLACEMENT	"1901.5.2 1908.4"	"ACI 318: CH. 20, 25.2, 25.3, 26.6.1-26.6.3, 26.13.3.3"		X	REINFORCING TO COMPLY WITH ALL CODE PROTECTION, SPACING AND TOLERANCE LIMITS.
INSPECT ANCHORS/BOLTS CAST IN CONCRETE	-	ACI 318: 17.8.2	X	X	ALL CAST-IN-PLACE ANCHORS/BOLTS SHALL BE VISUALLY INSPECTED. REFERENCE STEEL INSPECTIONS FOR ADDITIONAL INSTALLATION, MATERIAL AND WELDING INSPECTIONS OF STEEL ITEMS EMBEDDED IN CONCRETE (HEADED STUDS, DBA's, ETC.)
VERIFYING USE OF REQUIRED MIX DESIGN(S)	"1904.1 1904.2 1908.2 1908.3"	ACI 318: CH. 19, 26.4.3, 26.4.4		X	
CONCRETE SPECIMENS FOR TESTING	1908.10	"ASTM C172 ASTM C31 ACI 318: 26.5, 26.12"	X		PRIOR TO CONCRETE PLACEMENT, FABRICATE CONCRETE SPECIMENS FOR TESTING. SEE THE CONCRETE TESTING TABLE FOR ADDITIONAL INFORMATION.
CONCRETE PLACEMENT, NON-SHRINK GROUT	1908.6, 1908.7, 1908.8	ACI 318: 26.5, 26.13.3.2(a)	X		
CONCRETE CURING	1908.9000	ACI 318: 26.5.3 - 26.5.5, 26.13.3.3		X	VERIFY MAINTENANCE OF SPECIFIED CURING TEMPERATURES AND TECHNIQUES

CONCRETE - TESTING

SYSTEM OR MATERIAL	OSSC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY (NOTE 6)	REMARKS
CONCRETE STRENGTH	"1705.3 ASTM C172 ASTM C 31 ACI 318 26.12, ACI 318 26.5"	ASTM C39	EACH 150 CY NOR LESS THAN EACH 5000 SF OF SLAB OR WALL PLACED EACH SHIFT	FABRICATE SPECIMENS AT TIME FRESH CONCRETE IS PLACED
CONCRETE SLUMP		ASTM C143		
CONCRETE AIR CONTENT		ASTM C231		
CONCRETE TEMPERATURE		ASTM C1064		

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PSE
PETERSON STRUCTURAL ENGINEERS

NO. | DATE | REVISION | BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3D-G3 141 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2021 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SEIBAN LANE PUMP STATION
STRUCTURAL QUALITY ASSURANCE PLAN

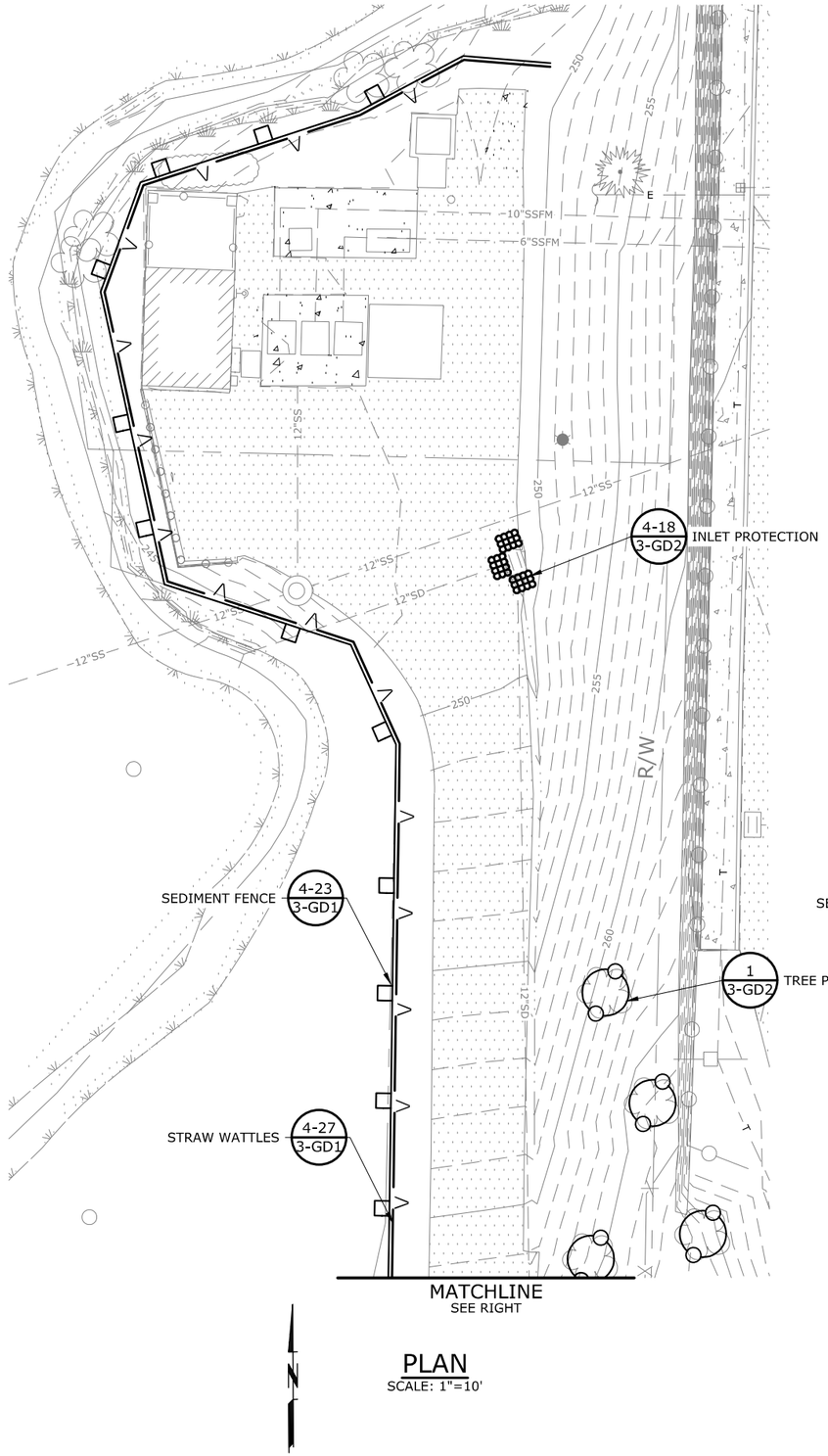
consor

DATE: MAY 2025

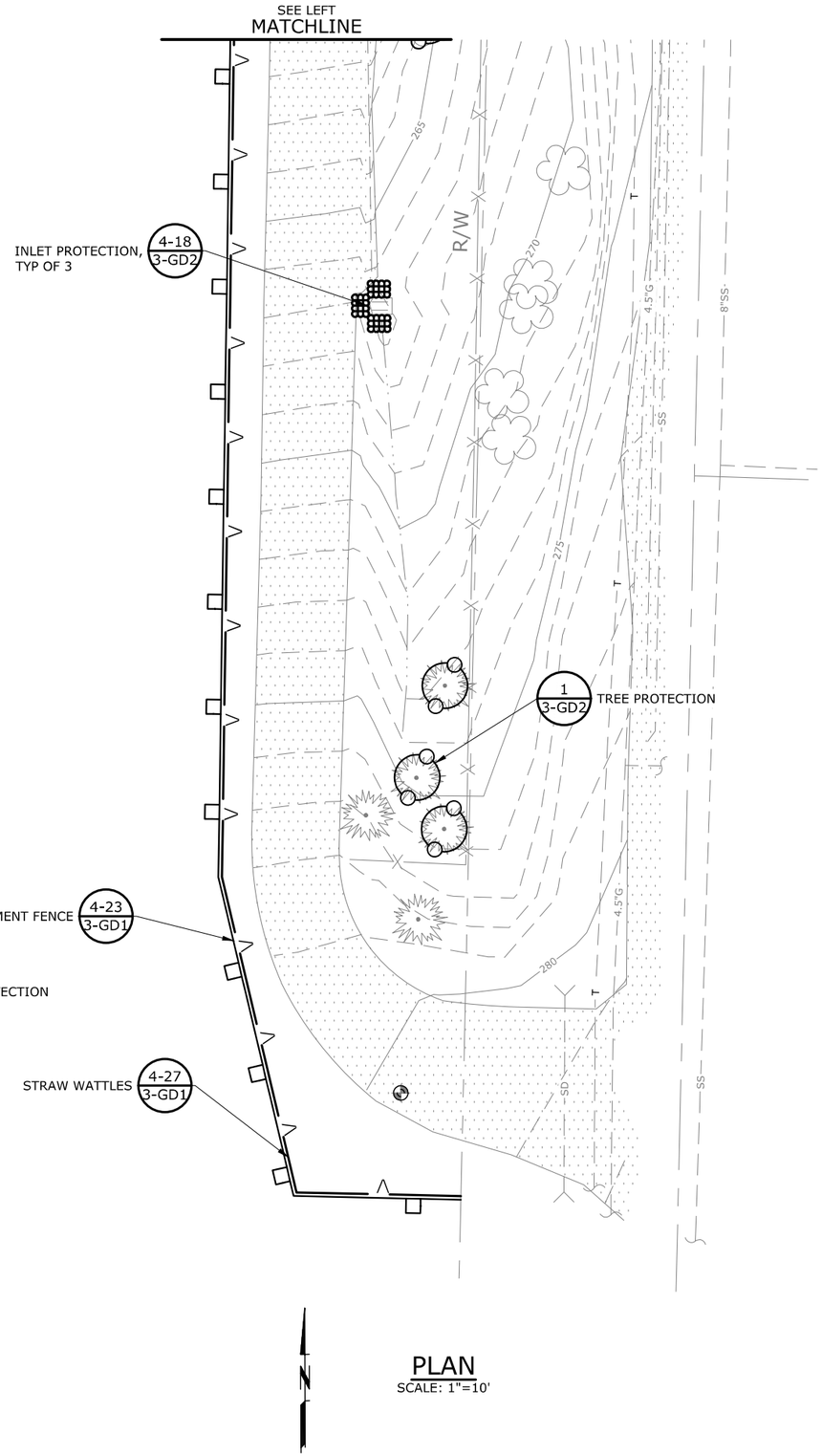
CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679

J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Updated Drawings\2025_05_05 Group 3 Final Drawings R2 1901-0206.dwg 3D-G3 5/6/2025 2:11 PM SAMRICHMANN 24.2s (LMS Tech)



PLAN
SCALE: 1"=10'



PLAN
SCALE: 1"=10'

NOTES:

1. INSTALL INLET PROTECTION ON INLET IN N 242ND AVENUE NEAR INTX WITH VILLAGE SLOPE COURT, NOT SHOWN.

2. INSTALL SILT FENCE AND STRAW WATTLES INSIDE OF TEMPORARY FENCING IN AREAS SHOWN.

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: DAM
APPROVED: XXX

SHEET 3D-C1
142 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 12, 2005
Nicholas S. Lafrenz
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
EROSION CONTROL PLAN

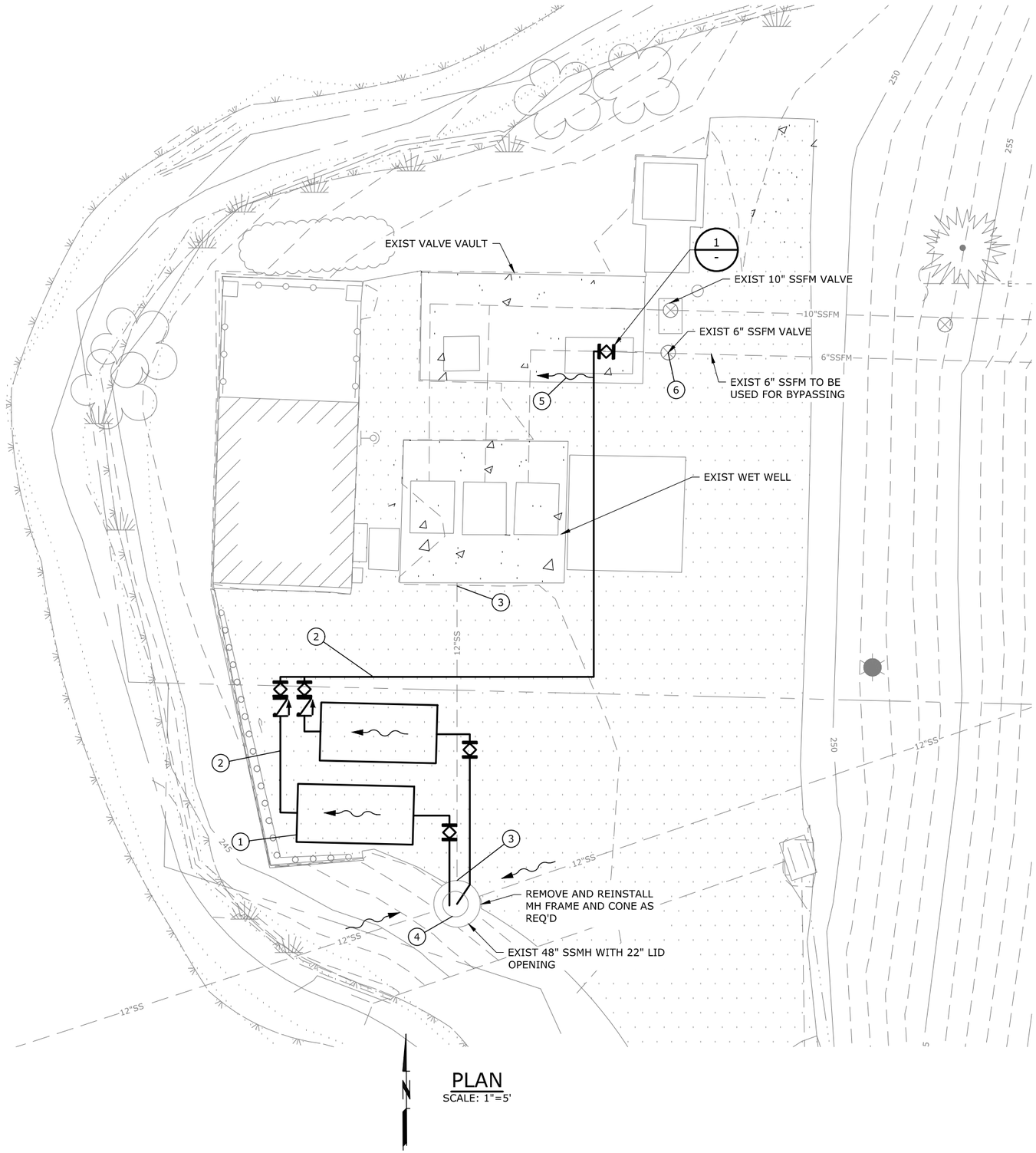
consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CADSheets\Group 2\19-2679-OR-GRP2-SCH B-C.dwg 3D-C1 9/9/2024 10:22 AM JEFFRY.ORLANDO 24.1s (LMS Tech)



PLAN
SCALE: 1"=5'

SHEET NOTES:

1. DESIGN, INSTALL, AND MAINTAIN BYPASS PUMPING SYSTEM TO MAINTAIN FLOWS AT ALL TIME PER SECTION 01 57 19.11.

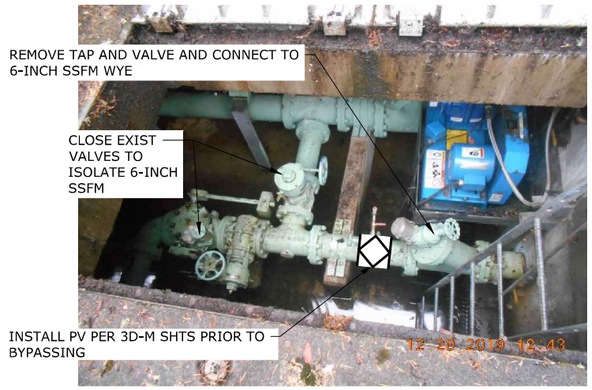
2. BYPASSING PLAN IS SCHEMATIC AND NOT INTENDED TO SHOW ALL REQUIREMENTS OR ACTUAL PLACEMENT OF EQUIPMENT AND PIPING.

3. COORDINATED BYPASSING INSTALLATION WITH WORK SEQUENCING PER SECTION 01 12 16.

4. RESTORE SITE SURFACING AND GRADES FOLLOWING REMOVAL OF BYPASSING EQUIPMENT.

KEY NOTES:

1. BYPASS PUMPS CONFIGURATION AND SIZE TO BE DESIGNED BY CONTRACTOR.
2. INSTALL HDPE PIPE WITH RESTRAINED JOINTS FOR PUMP SUCTION AND DISCHARGE PIPING.
3. INSTALL INFLATABLE PLUG INTO OUTLET SEWER.
4. REMOVE MANHOLE LID AND FRAME AS REQUIRED FOR PUMP SUCTION PIPING.
5. INSTALL CARV ON DISCHARGE PIPING.
6. CONTRACTOR TO CONFIRM EXISTING VALVE IS IN WORKING CONDITION PRIOR TO BYPASS.



BYPASS PORT CONNECTION
SCALE: NTS
1
-

NO.	DATE	REVISION	BY

DESIGNED: DWK
DRAWN: DKH
CHECKED: DAM
APPROVED: XXX

SHEET 3D-C2
143 of 184

REGISTERED PROFESSIONAL ENGINEER
98172
OREGON
Nicholas S. Lafrenz
Date:
RENEWS 12-31-26

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT
OREGON
JUDY THOMAS
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

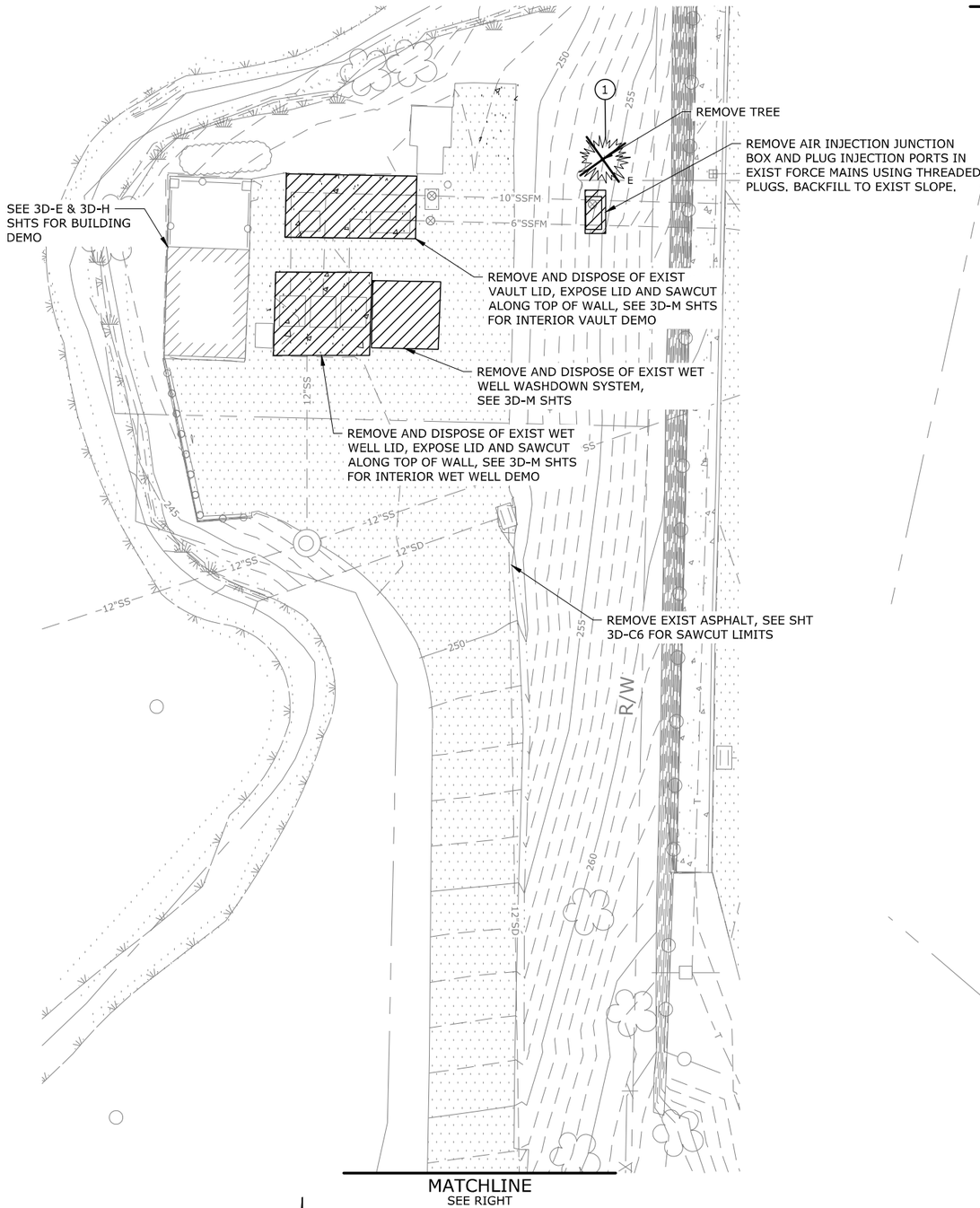
SIEBEN LANE PUMP STATION
BYPASS PUMPING PLAN AND DETAILS

consor

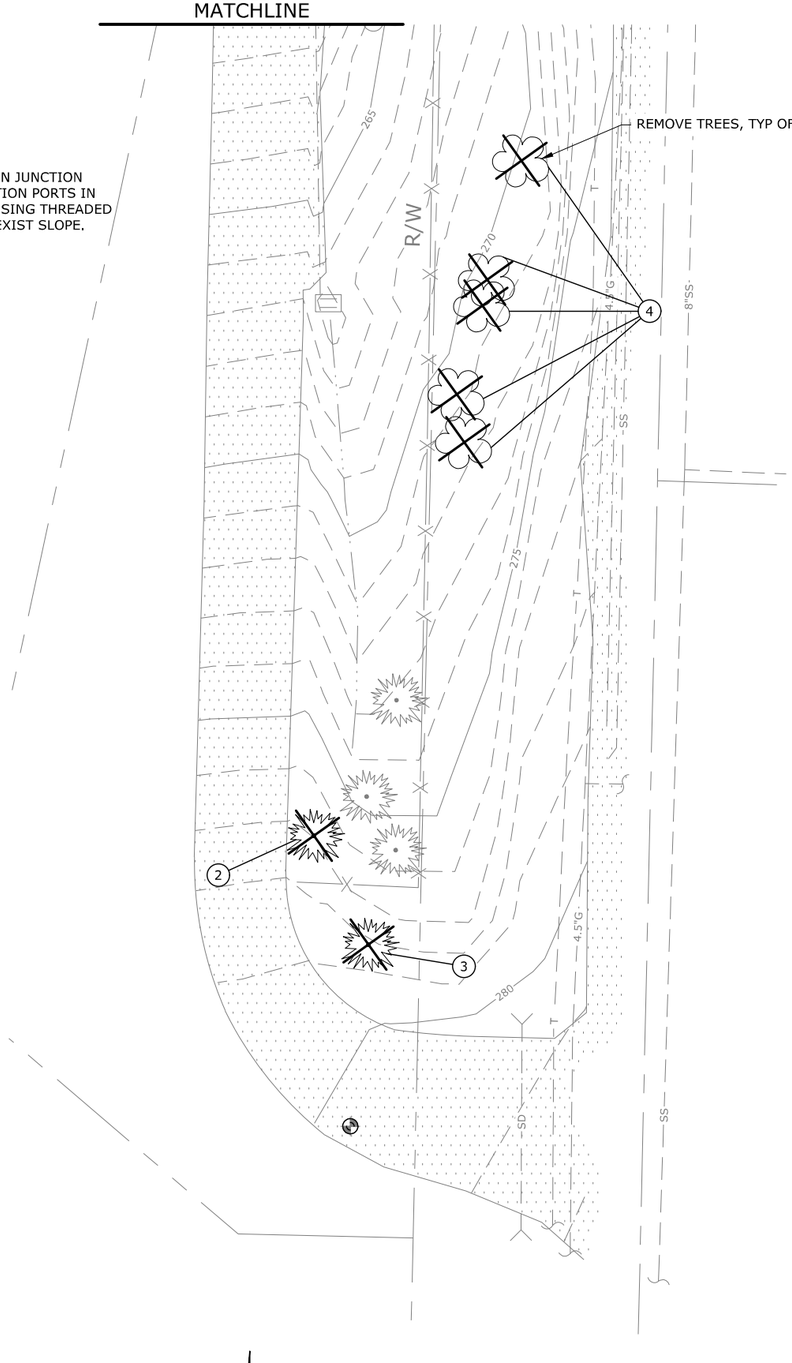
PROJECT: 19-2679
DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-C.dwg 3D-C2 9/9/2024 10:22 AM JEFFRY.ORLANDO 24.1s (LMS Tech)



PLAN
SCALE: 1"=10'



PLAN
SCALE: 1"=10'

TREE REMOVAL TABLE

NO.	TYPE	DBH (IN.)
1	DOUGLAS-FIR	27
2	INCENSE CEDAR	11
3	SCOTS PINE	14
4	MIX (MALUS SPECIES AND ACER MACRPHYLLUM)	VARIED (SMALL)

NO.	DATE	REVISION	BY

DESIGNED: CAS
DRAWN: BAB
CHECKED: MLC
APPROVED: AJC

SHEET 3D-C3
144 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98172 — Nicholas Alexander Laferriere — Date: 12/31/26
RENEWS 12-31-26

SCALE: VERT: AS SHOWN, HORIZ: AS SHOWN
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 – SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

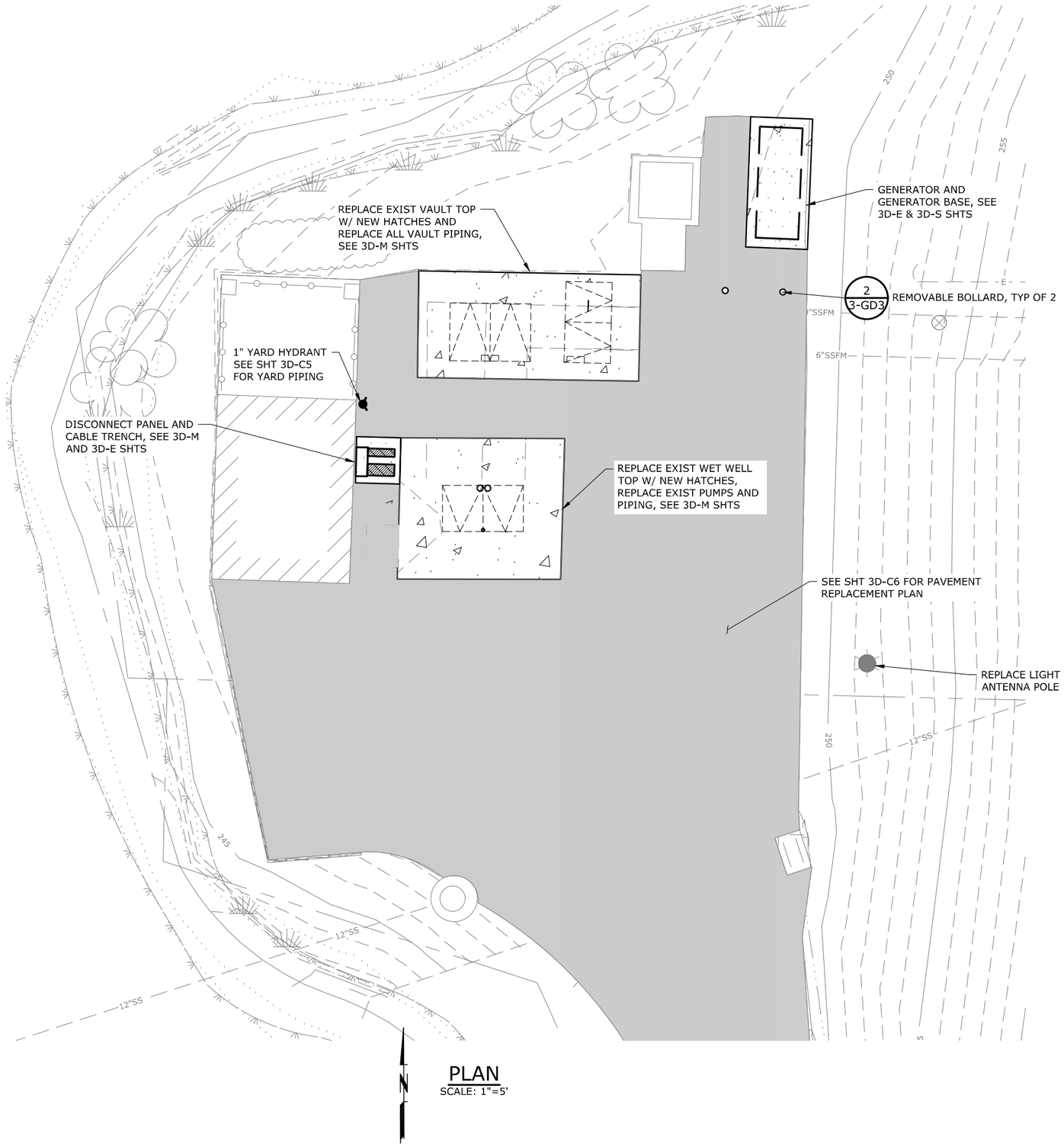
SIEBEN LANE PUMP STATION
SITE DEMOLITION PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-C.dwg 3D-C3 9/9/2024 10:22 AM JEFFRY.ORLANDO 24.1s (LMS Tech)



PLAN
SCALE: 1"=5'

NO.	DATE	REVISION	BY

DESIGNED: CAS
DRAWN: BAB
CHECKED: MLC
APPROVED: AJC

SHEET 3D-C4
145 of 184

REGISTERED PROFESSIONAL ENGINEER
98172
Nicholas Alexander Laferriere
Date:
RENEWS 12-31-26

OREGON
LICENSED LANDSCAPE ARCHITECT
Nicholas A. Laferriere
Date:
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SCHEDULE B: SIEBEN LANE PUMP STATION
SITE PLAN

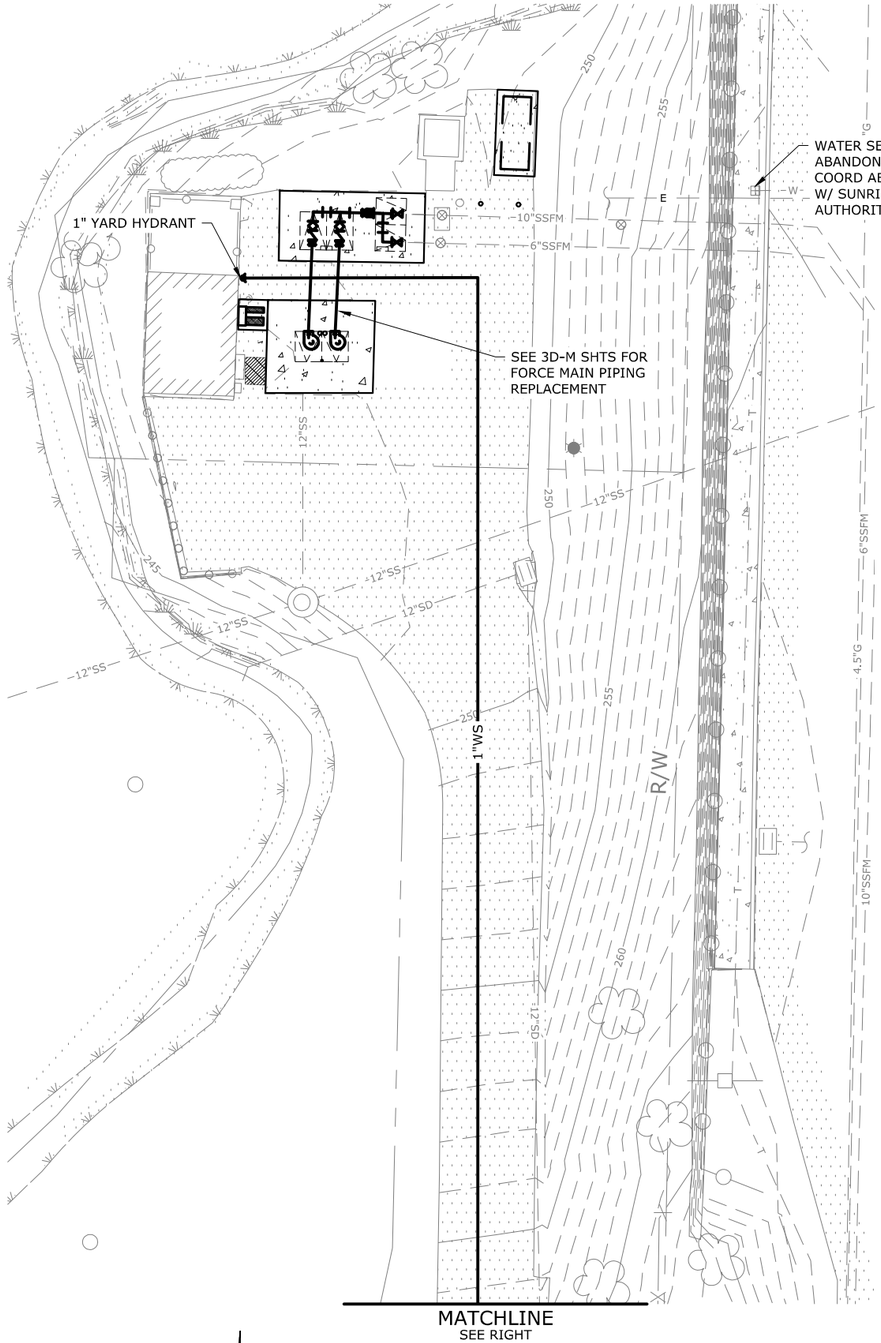
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CLACKAMAS WATER ENVIRONMENT SERVICES

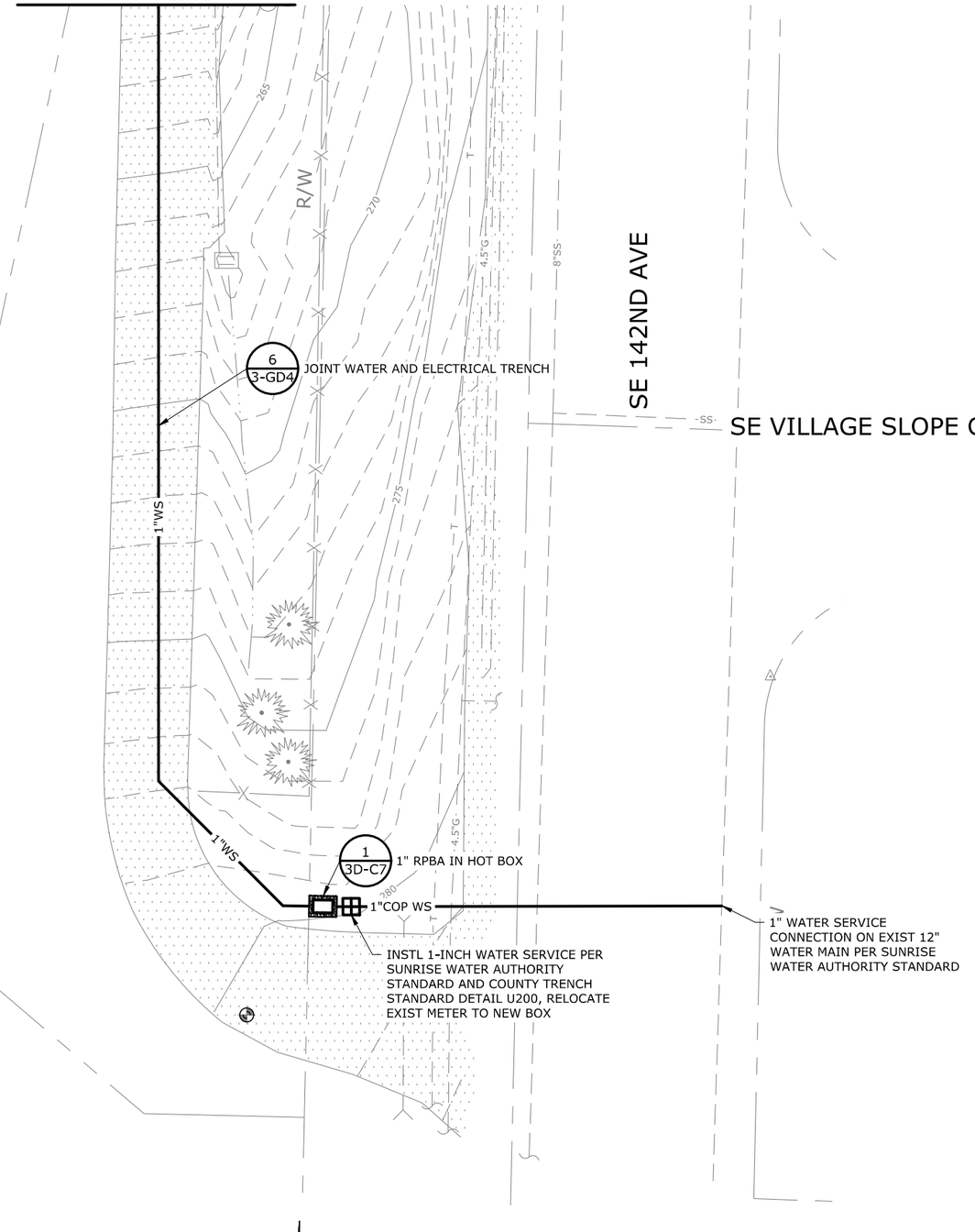
PROJECT: 19-2679
DATE: MAY 2025

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g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-C.dwg 3D-C5 9/9/2024 10:22 AM JEFFRY.ORLANDO 24.1s (LMS Tech)



PLAN
SCALE: 1"=10'



PLAN
SCALE: 1"=10'

NO.	DATE	REVISION	BY

DESIGNED: CAS
DRAWN: BAB
CHECKED: MLC
APPROVED: AJC

SHEET 3D-C5
146 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98126 — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98126 — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

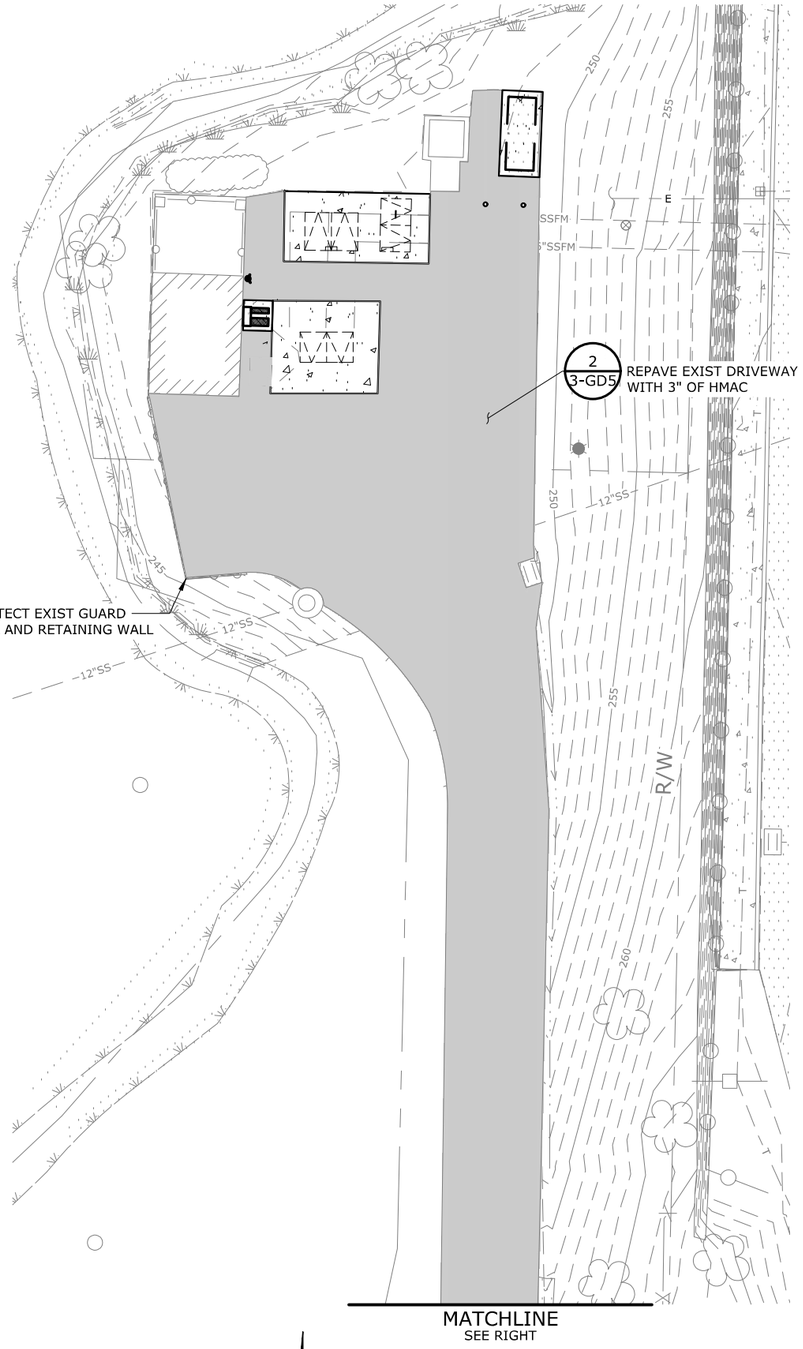
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
SITE PIPING PLAN

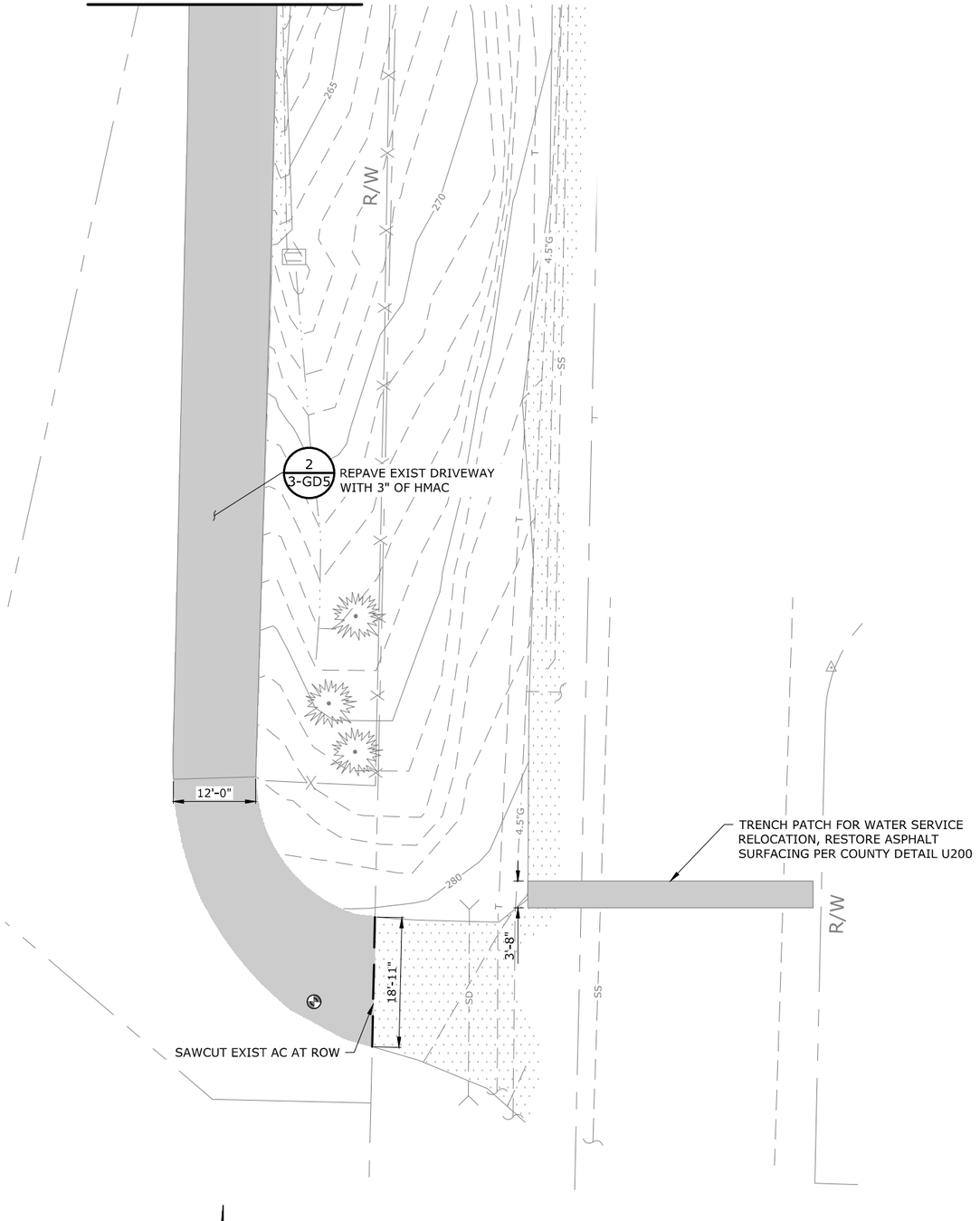
consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025



PLAN
SCALE: 1"=10'



PLAN
SCALE: 1"=10'

NO.	DATE	REVISION	BY

DESIGNED: CAS
DRAWN: BAB
CHECKED: MLC
APPROVED: AJC

SHEET 3D-C6
147 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — 98172 — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

REGISTERED PROFESSIONAL LAND SURVEYOR — OREGON — 2008 — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
SURFACING AND GRADING PLAN

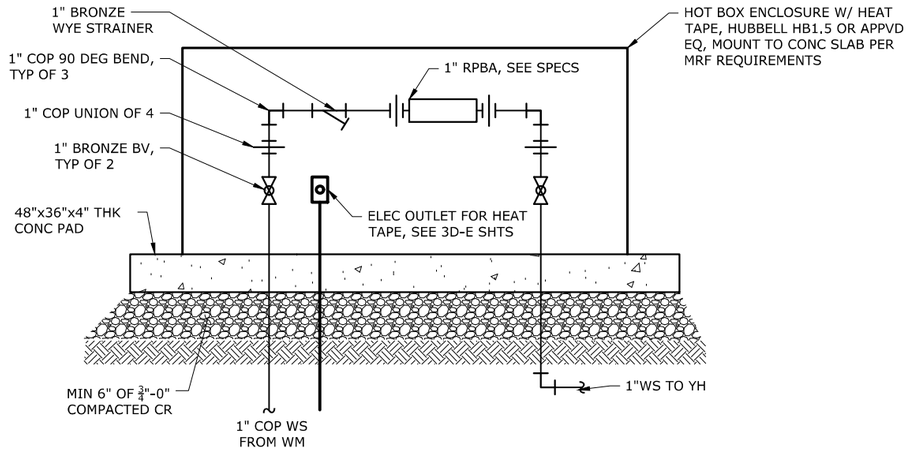
consor

DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679

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HOT BOX AND PLUMBING DETAIL

SCALE: NTS

1
3D-C5

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NO.	DATE	REVISION	BY

SHEET 3D-C7

148 of 184

DESIGNED: CAS
DRAWN: BAB
CHECKED: MLC
APPROVED: AJC

REGISTERED PROFESSIONAL ENGINEER
OREGON
98172
Nicholas A. Lafrenz
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0
1

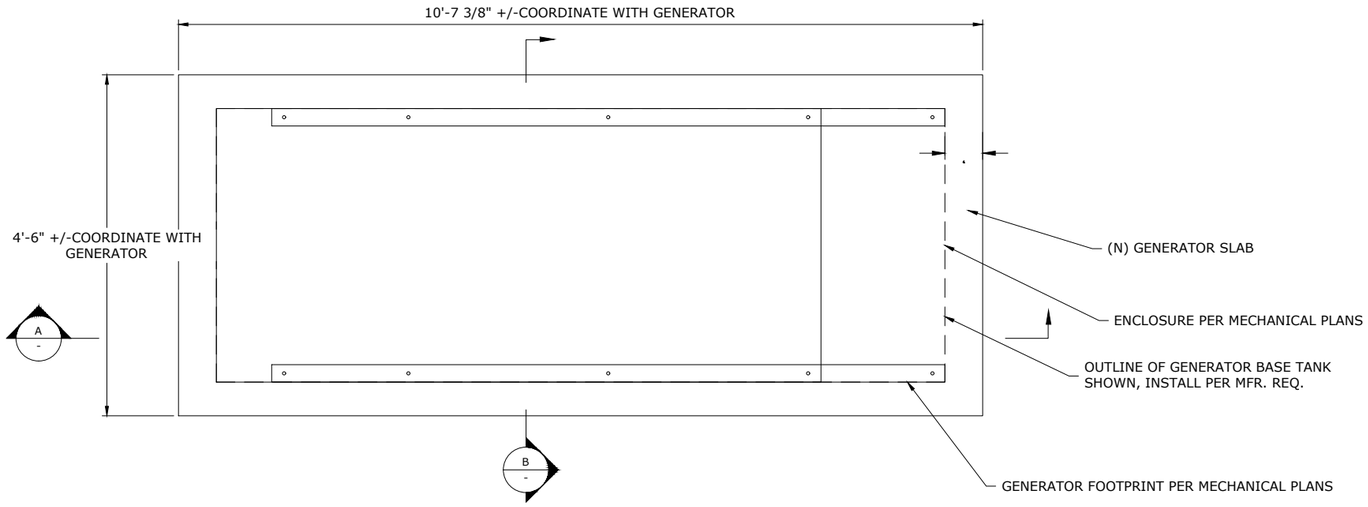
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
CIVIL DETAILS

CLACKAMAS WATER ENVIRONMENT SERVICES

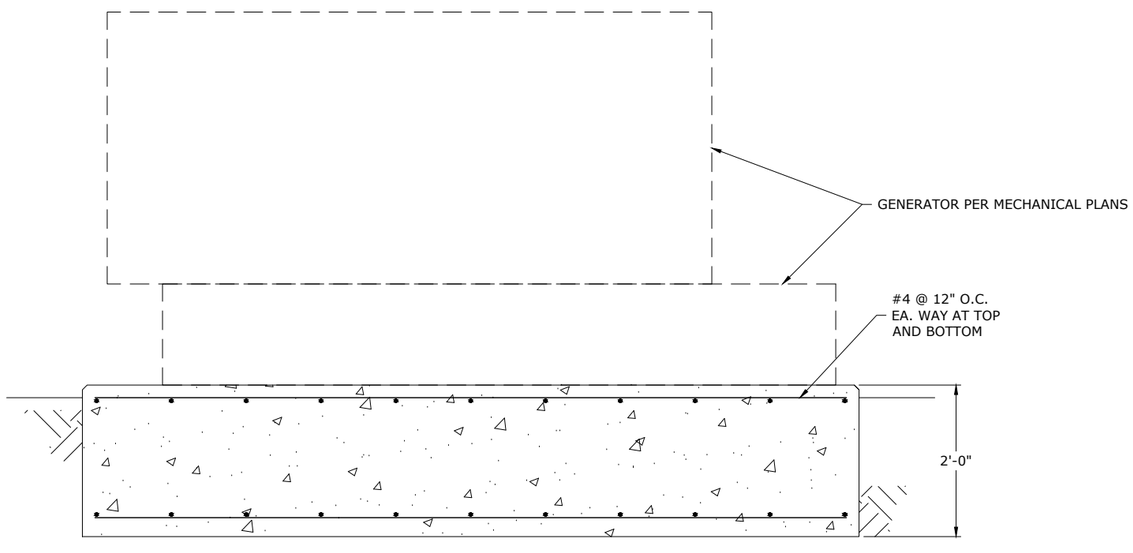
consor

PROJECT: 19-2679 | DATE: MAY 2025



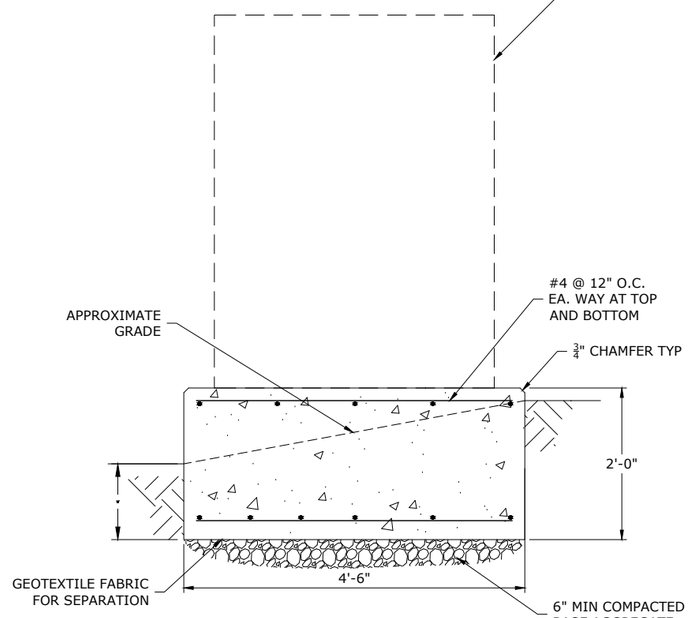
GENERATOR SLAB PLAN

1" = 1'-0"



GENERATOR SLAB SECTION (A / –)

1" = 1'-0"



GENERATOR SLAB SECTION (B / –)

1" = 1'-0"

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PSE PETERSON STRUCTURAL ENGINEERS

NO. | DATE | REVISION | BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3D-S1 149 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE OREGON NOV. 9, 2012 ETHAN DAVID ALTON

EXPIRES 12/31/25

SCALE | VERT: AS SHOWN | HORIZ: AS SHOWN

NOTICE: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 – 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SEIBEN LANE PUMP STATION
GENERATOR SLAB DETAILS

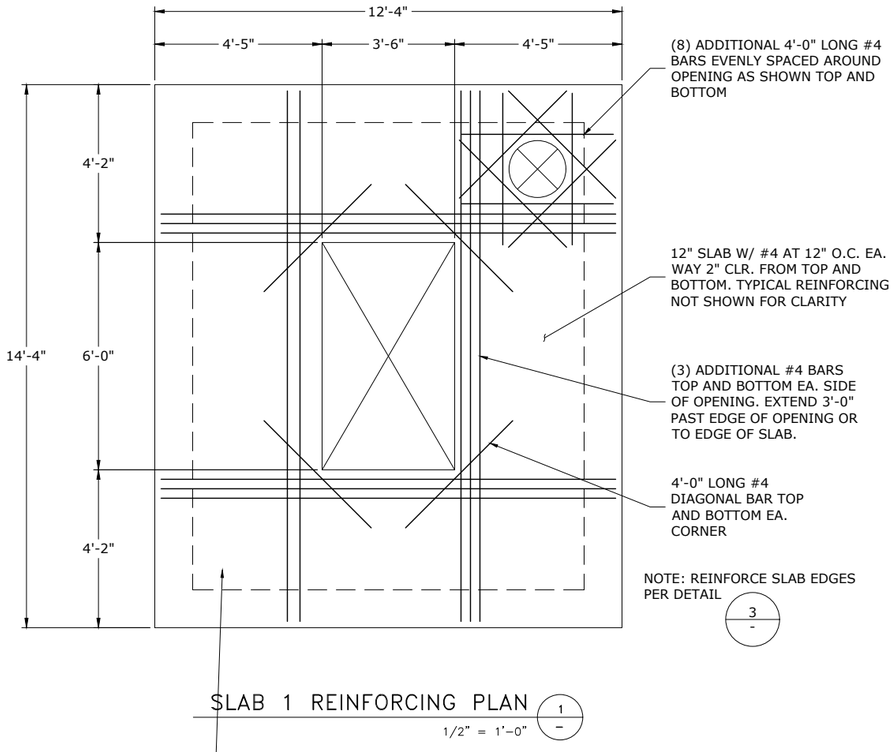
consor

DATE: MAY 2025

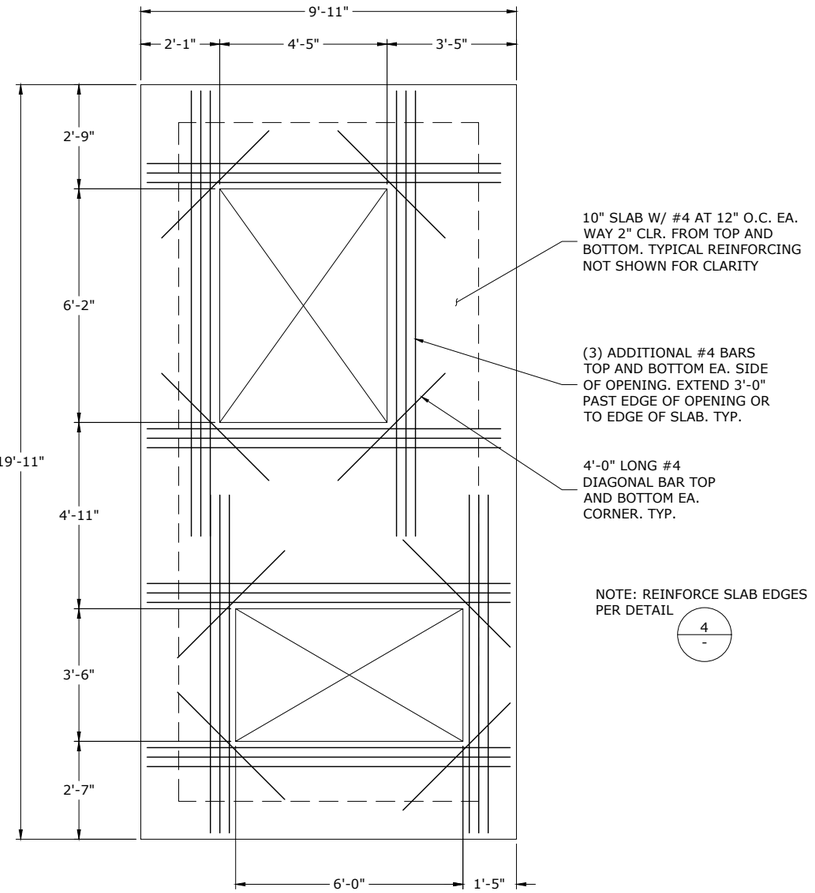
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

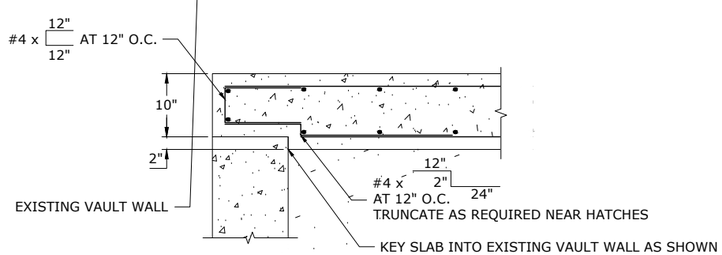
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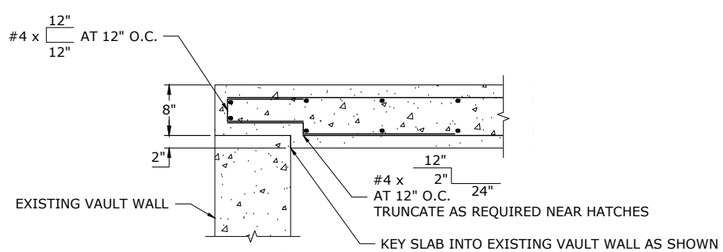
SLAB 1 REINFORCING PLAN 1
1/2" = 1'-0"



SLAB 2 REINFORCING PLAN 2
1/2" = 1'-0"



SLAB 1 EDGE DETAIL 3
1/2" = 1'-0"



SLAB 2 EDGE DETAIL 4
1/2" = 1'-0"

9400 SW Barnes Rd.
Suite 100
Portland, Oregon 97225
(503) 292-1635

PSE Project #: 1901-0206

Date: 05/06/2025

PETERSON STRUCTURAL ENGINEERS

NO. | DATE | REVISION | BY

DESIGNED: SDR
DRAWN: SDR
CHECKED: EDA
APPROVED: TGM

SHEET 3D-S2

150 of 184

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 88998PE
ETHAN DAVID ALTON
OREGON
NOV. 9, 2021

EXPIRES 12/31/25

SCALE | VERT: AS SHOWN | HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SEIBEN LANE PUMP STATION
VAULT SLAB AND DETAILS

consor

DATE: MAY 2025

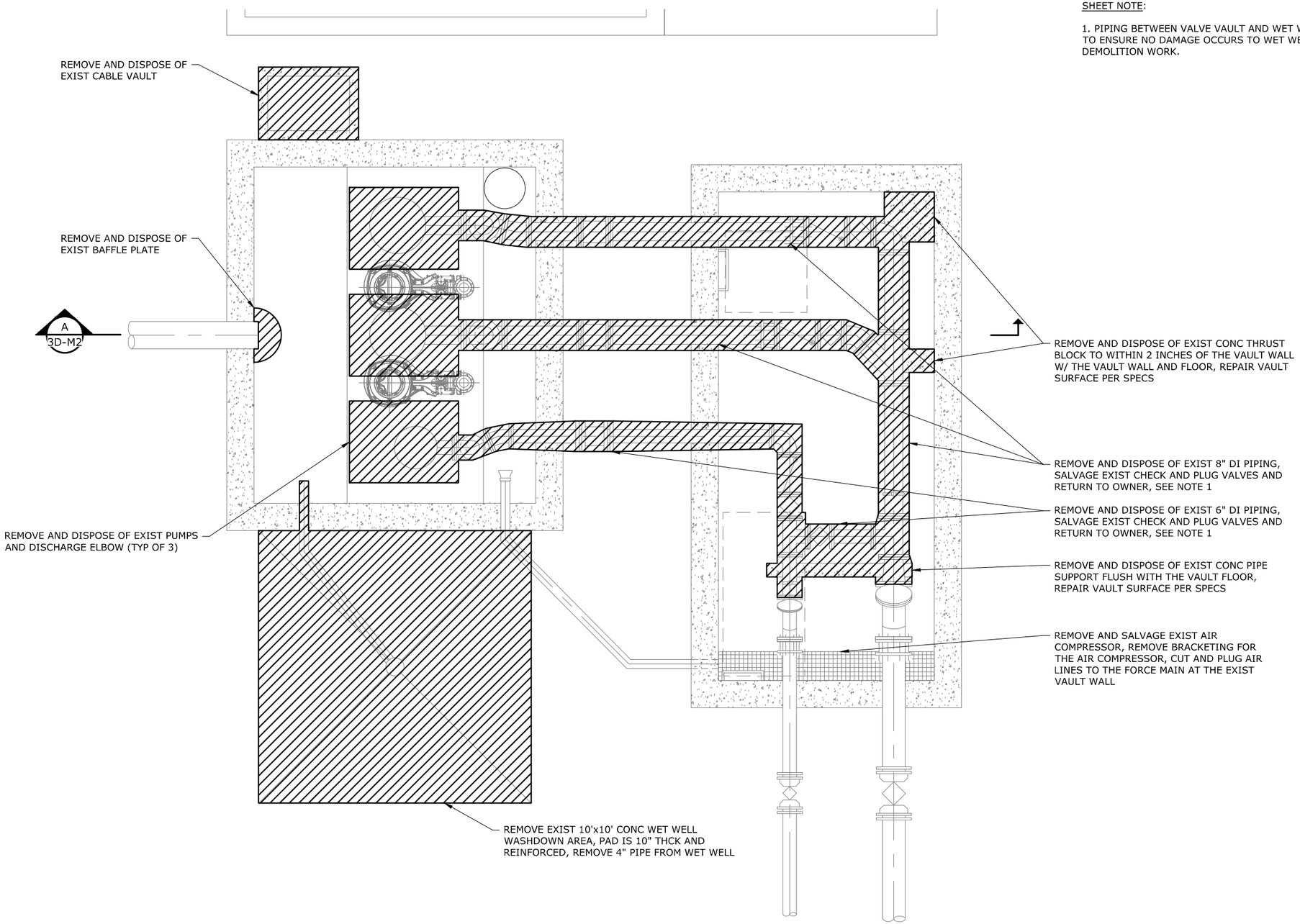
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Group 3 Final Drawings R2 1901-0206.dwg 3D-S2 5/6/2025 2:11 PM SAMRICHMANN 24.2s (LMS Tech)
J:\01-PDX\1901-0201 to 1901-0225\1901-0206\1 - Project Data Files\Group 3\2025_05_05 Updated Drawings\2025_05_05

SHEET NOTE:

1. PIPING BETWEEN VALVE VAULT AND WET WELL IS CONCRETE ENCASED. CONTRACTOR TO ENSURE NO DAMAGE OCCURS TO WET WELL AND VALVE VAULT DURING PIPE DEMOLITION WORK.



PLAN
SCALE: 1/2"=1'-0"

NO.	DATE	REVISION	BY

DESIGNED: CAS
DRAWN: JSD
CHECKED: EPK
APPROVED: AJC

SHEET 3D-M1 151 of 184

REGISTERED PROFESSIONAL ENGINEER
98172
OREGON
Nicholas S. Lafrenz
Date:
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

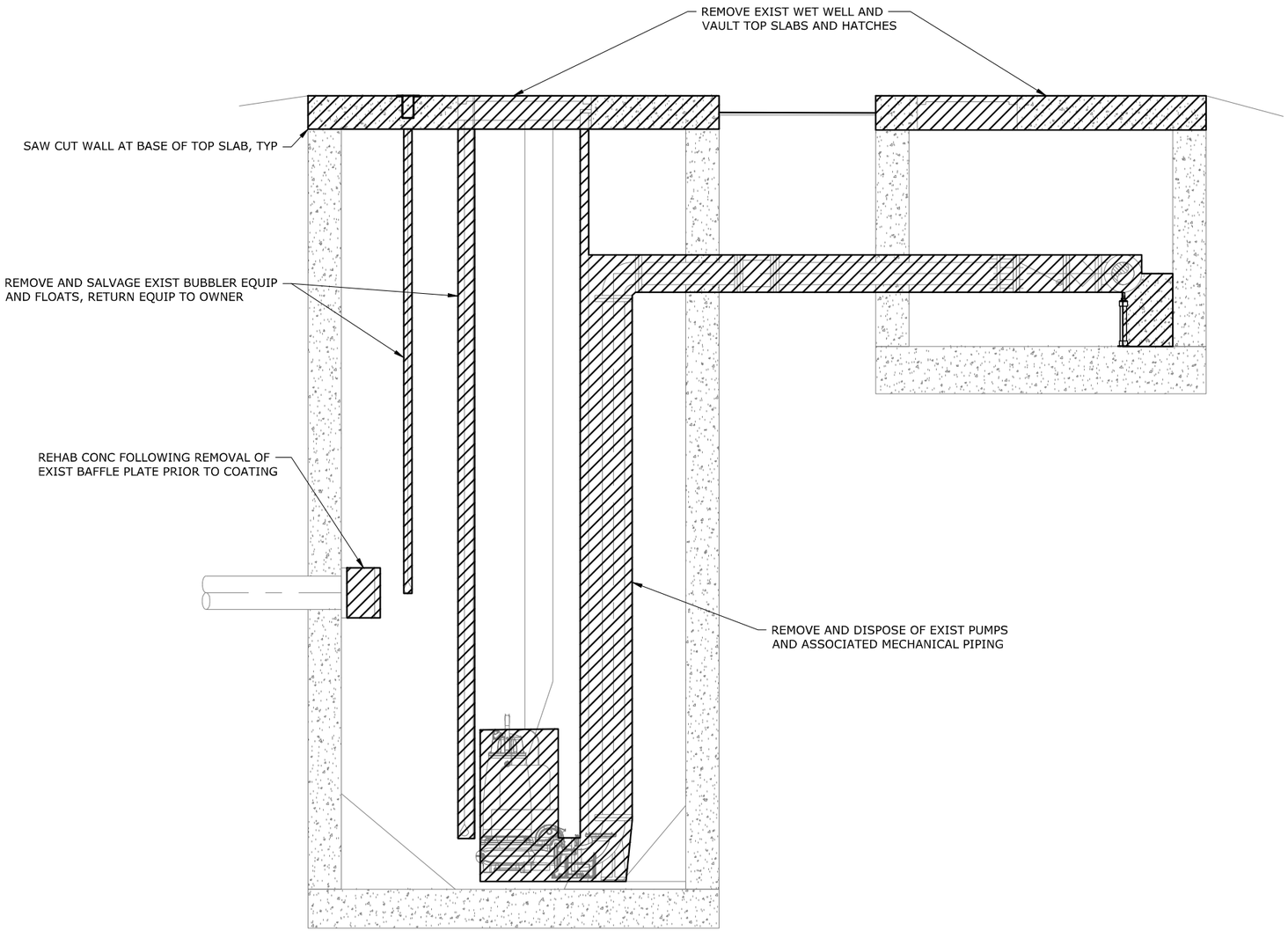
SIEBEN LANE PUMP STATION MECHANICAL DEMO PLAN

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabiltation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-M.dwg 3D-M1 4/29/2025 2:22 PM NICK.MCFADDIN 24.1s (LMS Tech)



SECTION

SCALE: 1/2"=1'-0"

A
3D-M1

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-M.dwg 3D-M2 4/29/2025 2:22 PM NICK.MCFADDIN 24.1s (LMS Tech)

NO.	DATE	REVISION	BY

DESIGNED: CAS
DRAWN: JSD
CHECKED: EPK
APPROVED: AJC

SHEET 3D-M2 152 of 184

REGISTERED PROFESSIONAL ENGINEER — 98172 — OREGON — Nicholas S. Lafrenz — Date: — RENEWS 12-31-26

REGISTERED PROFESSIONAL ENGINEER — OREGON — JAMES A. THRALL — 12/31/26

SCALE: VERT: AS SHOWN HORIZ: AS SHOWN

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

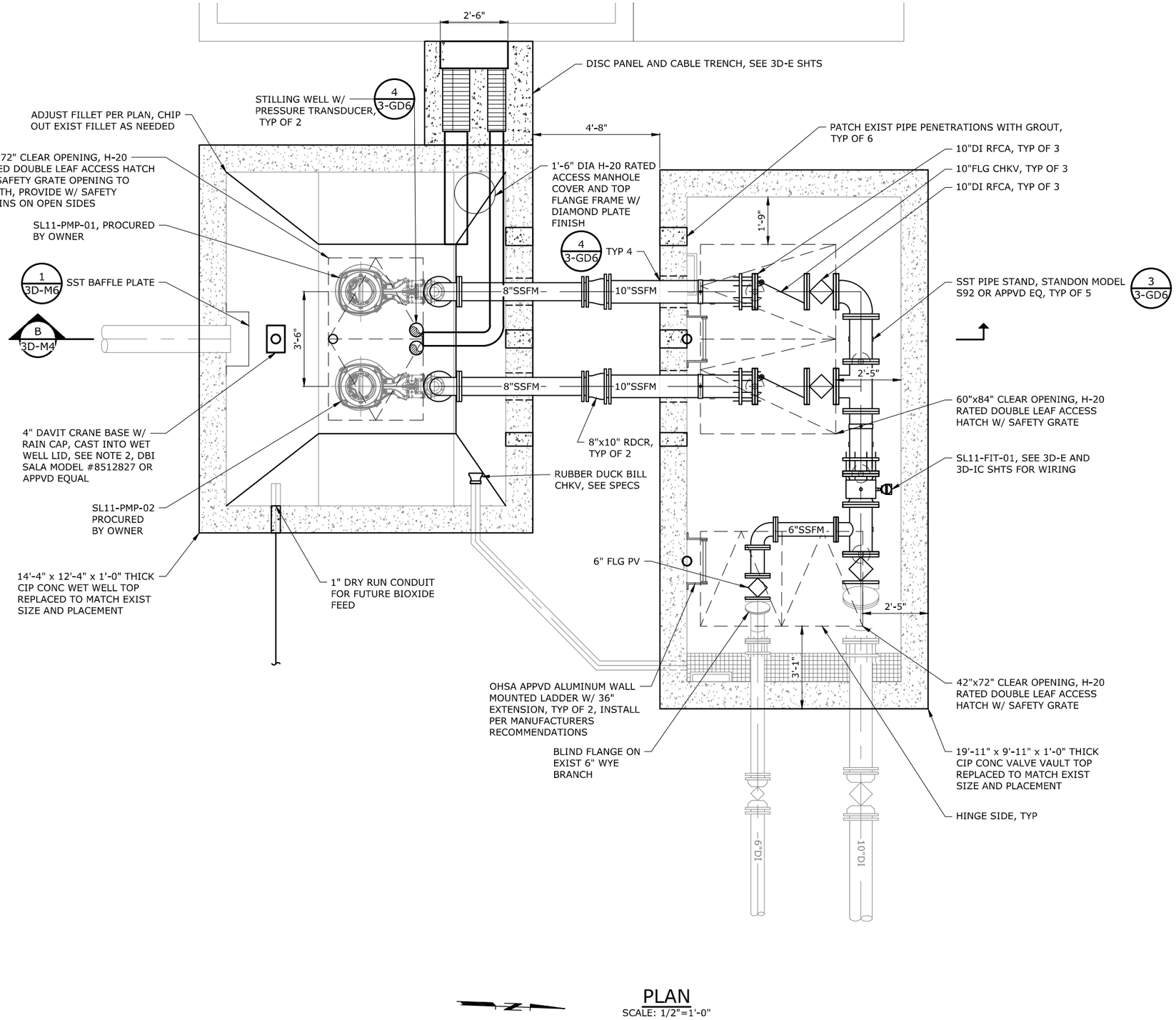
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
MECHANICAL DEMO SECTION

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025



PLAN
SCALE: 1/2"=1'-0"

SHEET NOTE:

1. ALL PIPE TO BE MECHANICALLY RESTRAINED.

2. DAVIT CRANE LOCATION IS APPROXIMATE, CONTRACTOR TO COORDINATE WET WELL LID REINFORCEMENT TO PROVIDE ADEQUATE SUPPORT FOR DAVIT CRANE.

3. PUMPS ARE XYLEM SUBMERSIBLE PUMPS PROVIDED BY THE OWNER FOR CONTRACTOR TO INSTALL.

NO.	DATE	REVISION	BY

SHEET 3D-M3
153 of 184

DESIGNED: CAS
DRAWN: JSD
CHECKED: EPK
APPROVED: AJC

REGISTERED PROFESSIONAL ENGINEER 9812 OREGON Nicholas Scott Laferriz Date: 12/31/25
RENEWS 12-31-26

SCALE VERT: AS SHOWN HORIZ: AS SHOWN
NOTICE 0 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION MECHANICAL PLAN

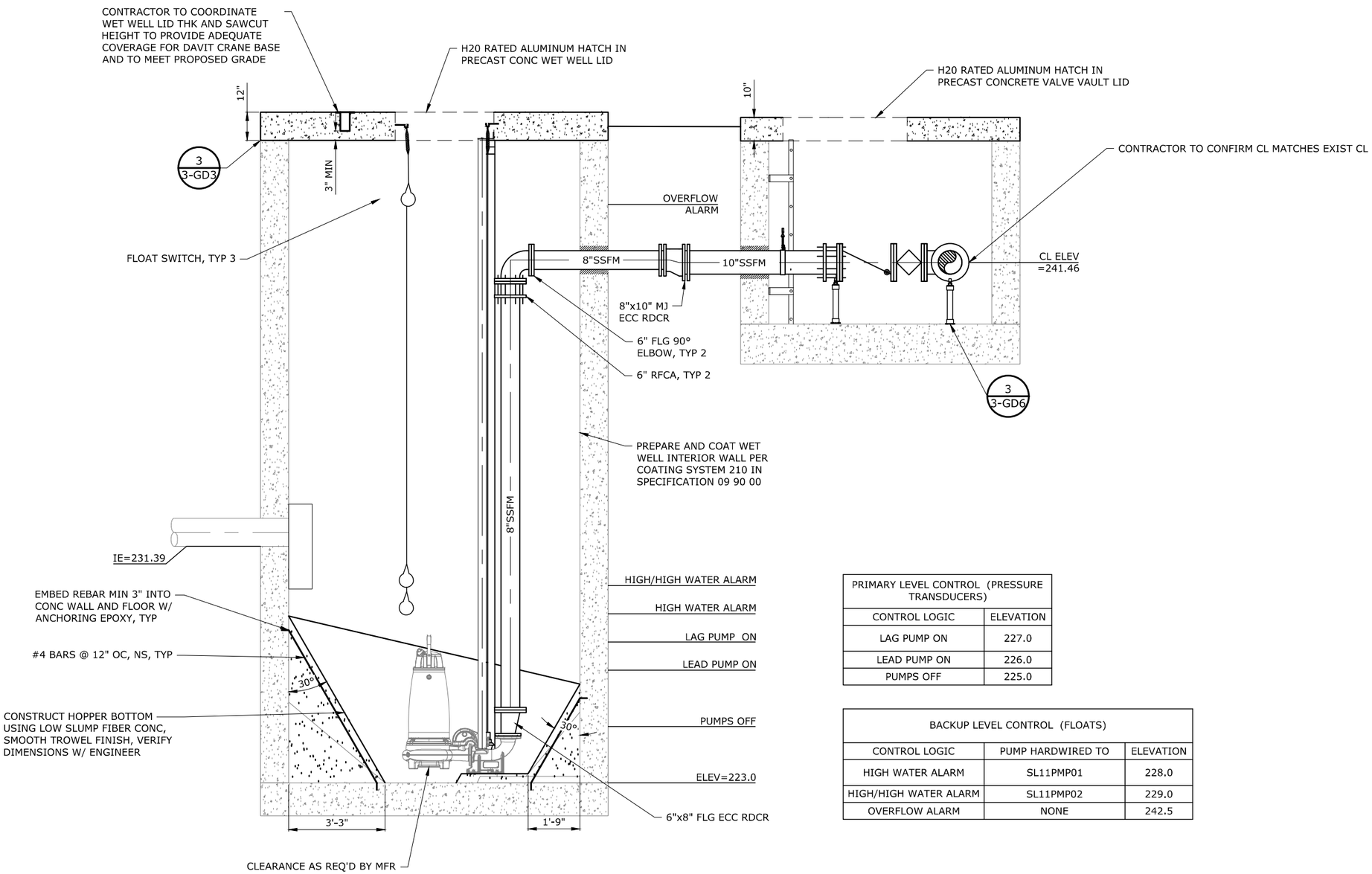
consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-M.dwg 3D-M3 4/29/2025 2:22 PM NICK.MCFADDIN 24.1s (LMS Tech)



SECTION B

SCALE: 1/2"=1'-0"

3D-M3

PRIMARY LEVEL CONTROL (PRESSURE TRANSDUCERS)	
CONTROL LOGIC	ELEVATION
LAG PUMP ON	227.0
LEAD PUMP ON	226.0
PUMPS OFF	225.0

BACKUP LEVEL CONTROL (FLOATS)		
CONTROL LOGIC	PUMP HARDWIRED TO	ELEVATION
HIGH WATER ALARM	SL11PMP01	228.0
HIGH/HIGH WATER ALARM	SL11PMP02	229.0
OVERFLOW ALARM	NONE	242.5

NO. | DATE | REVISION | BY

DESIGNED: CAS
DRAWN: JSD
CHECKED: EPK
APPROVED: AJC

SHEET 3D-M4
154 of 184

REGISTERED PROFESSIONAL ENGINEER 98172 OREGON Nicholas Laferriere
Nicholas A. Laferriere
Date: 12-31-26
RENEWS 12-31-26

SCALE | VERT: AS SHOWN | HORIZ: AS SHOWN
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
MECHANICAL SECTION

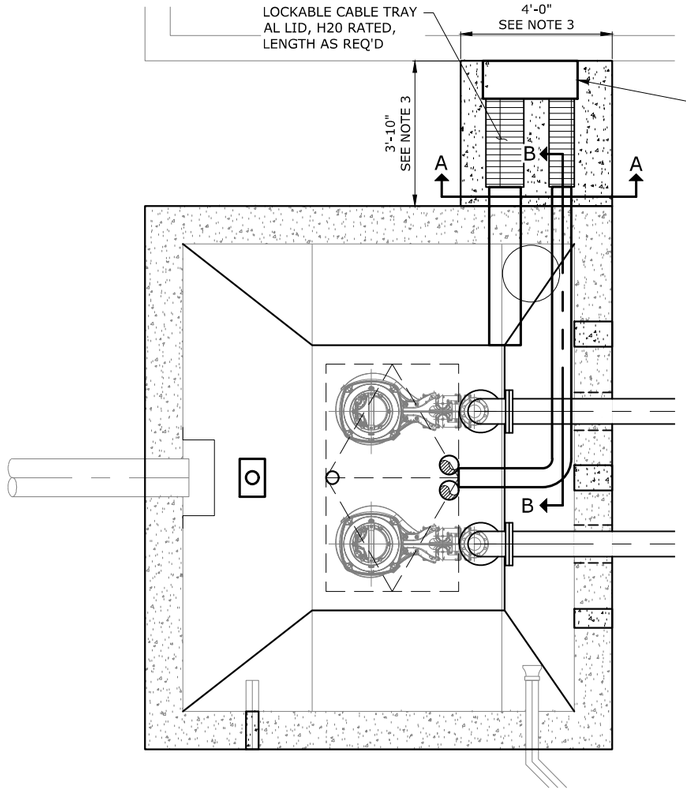
consor

DATE: MAY 2025

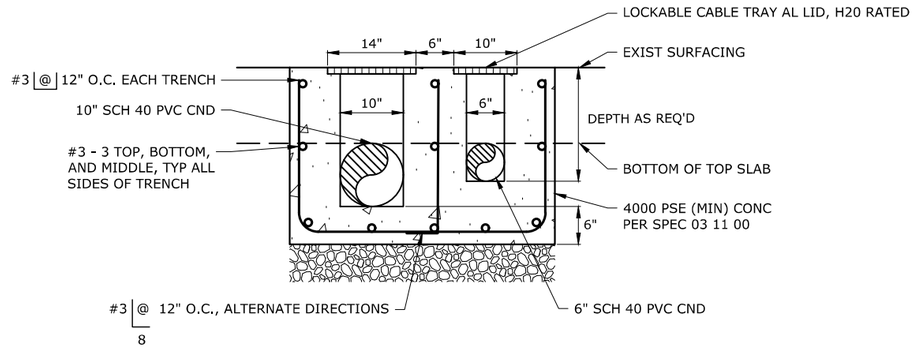
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

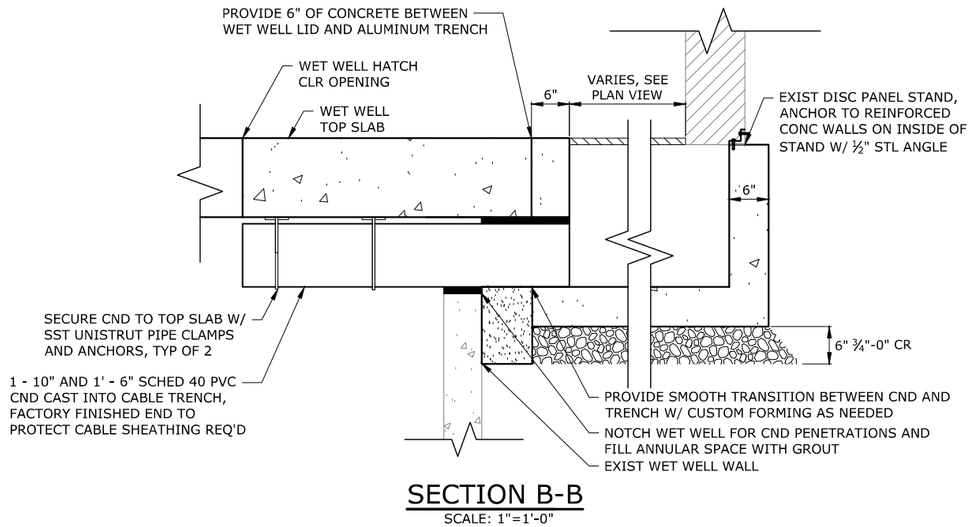
g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-M.dwg 3D-M4 4/29/2025 2:22 PM NICK.MCFADDIN 24.1s (LMS Tech)



PLAN
SCALE: 1/2"=1'-0"



SECTION A-A
SCALE: 1"=1'-0"



SECTION B-B
SCALE: 1"=1'-0"

NOTES:

1. THE CABLE TRENCH SHALL BE A COMPLETE PRE-ENGINEERED SYSTEM AS SPECIFIED IN 05 50 00.

2. PROVIDE LIGHT BROOM FINISH ON CONCRETE SURFACE, AND SACK FINISH WITHIN TRENCHES.

3. ALL DIMENSIONS ARE BASED OFF AS-BUILTS. CONTRACTOR TO VERIFY MEASUREMENTS IN THE FIELD AND ADJUST ACCORDINGLY.

NO.	DATE	REVISION	BY

DESIGNED: CAS
DRAWN: JSD
CHECKED: EPK
APPROVED: AJC

SHEET 3D-M5

155 of 184

REGISTERED PROFESSIONAL ENGINEER — 98172 — Nicholas Steven Laferriz — OREGON — RENEWS 12-31-26

REGISTERED LICENSED LANDSCAPE ARCHITECT — Nicholas S. Laferriz — OREGON — Date:

SCALE: VERT: AS SHOWN, HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
CABLE TRENCH CONFIGURATION

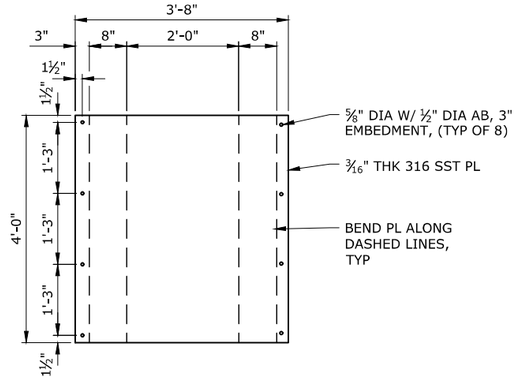
consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabiltation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-M.dwg 3D-M5 4/29/2025 2:22 PM NICK.MCFADDIN 24.1s (LMS Tech)



ELEVATION

SST INFLUENT BAFFLE PLATE

SCALE: NTS

1
3D-M3

g:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-M.dwg 3D-M6 4/29/2025 2:22 PM NICK.MCFADDIN 24.1s (LMS Tech)

NO.	DATE	REVISION	BY

DESIGNED: CAS
DRAWN: JSD
CHECKED: EPK
APPROVED: AJC

SHEET
3D-M6
156 of 184

REGISTERED PROFESSIONAL ENGINEER
98172
Nicholas S. Laferriere
Date:
RENEWS 12-31-26

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT
OREGON
LANDS ITHMUS
RENEWS 12-31-26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0
1

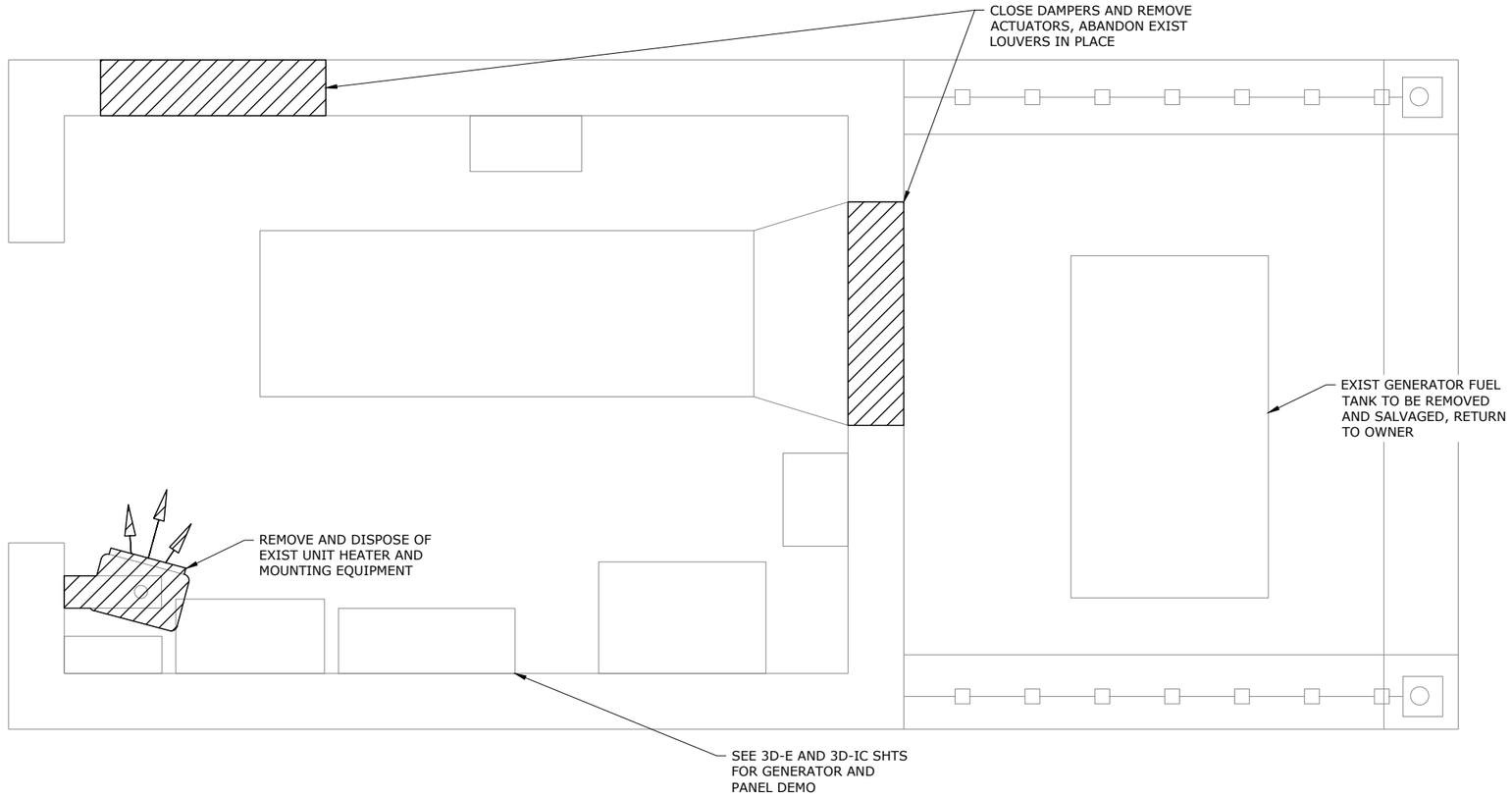
PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
MECHANICAL DETAILS

CLACKAMAS WATER ENVIRONMENT SERVICES

consor

PROJECT: 19-2679 DATE: MAY 2025



PLAN
SCALE: 3/4"=1'-0"

NO.	DATE	REVISION	BY

DESIGNED: LLU
DRAWN: DKH
CHECKED: AJC
APPROVED: AMB

SHEET 3D-H1
157 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JUNE 11, 2009 — ALEX M. BARGNESER
RENEWS 12-31-25

SCALE: VERT: AS SHOWN, HORIZ: AS SHOWN
NOTICE: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 — 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

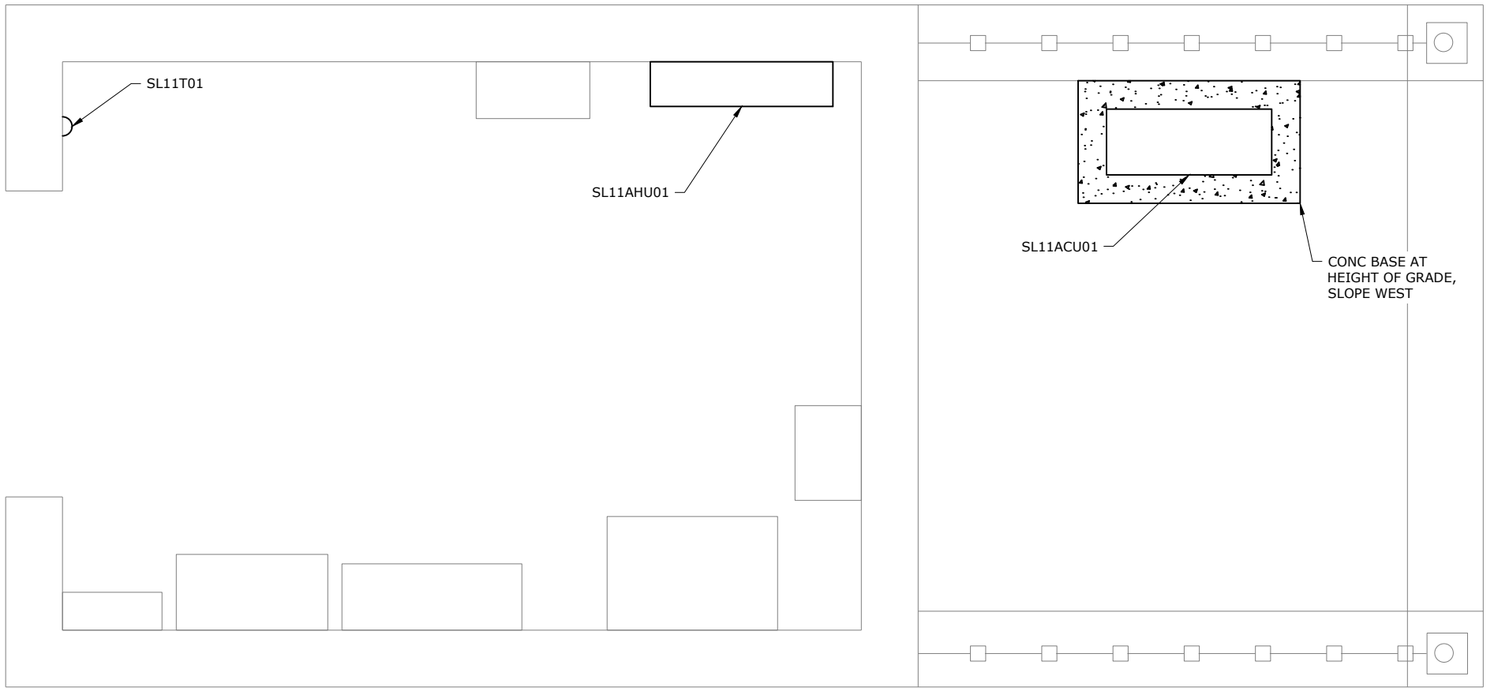
SIEBEN LANE PUMP STATION
HVAC DEMO PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

G:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-H.dwg 3D-H1 5/8/2025 3:43 PM JACOB.COLES 24.1s (LMS Tech)



PLAN
SCALE: 3/4"=1'-0"

SPLIT SYSTEM HEAT PUMP						
TAG NO.	LOCATION	COOLING UNIT TOTAL CAPACITY (BTUH)	HEATING UNIT TOTAL CAPACITY (BTUH)	CONTROL	VOLTS/PHASE	MANUFACTURER & MODEL
SL11AHU01	ELECTRICAL/CONTROL ROOM	12,000	14,000	T-1	115 / 1	FUJITSU, ASU12RL2
SL11ACU01	OUTSIDE	12,000	14,000	T-1		FUJITSU, AUO12RL2

THERMOSTATS					
TAG NO.	LOCATION	TYPE	TEMPERATURE RANGE	VOLTS/PHASE	MANUFACTURER & MODEL
SL11T01	ELECTRICAL/CONTROL ROOM	WIRED REMOTE	32°F-114°F	12V DC	FUJITSU, UTY-RNNUM

SHEET NOTES:

1. CONTRACTOR TO VERIFY ALL HVAC EQUIPMENT MOUNTING LOCATIONS IN FIELD WITH ENGINEER.

2. CONTRACTOR TO COORDINATE LOCATION OF WALL MOUNTED UNITS WITH EXISTING ELECTRICAL AND PLUMBING.

3. EQUIPMENT MANUFACTURERS AND MODEL NUMBERS ARE PROVIDED FOR REFERENCE ONLY AND SHALL BE USED TO ESTABLISH EQUIPMENT SIZES AND REQUIRED PERFORMANCE. APPROVED EQUAL MANUFACTURERS WILL BE ACCEPTED.

NO. | DATE | REVISION | BY

DESIGNED: LLU
DRAWN: DKH
CHECKED: AJC
APPROVED: AMB

SHEET 3D-H2
158 of 184

REGISTERED PROFESSIONAL ENGINEER
STATE OF TEXAS 79401
OREGON
JUNE 11, 2009
ALEX M. BARGNESS
RENEWS 12-31-25

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

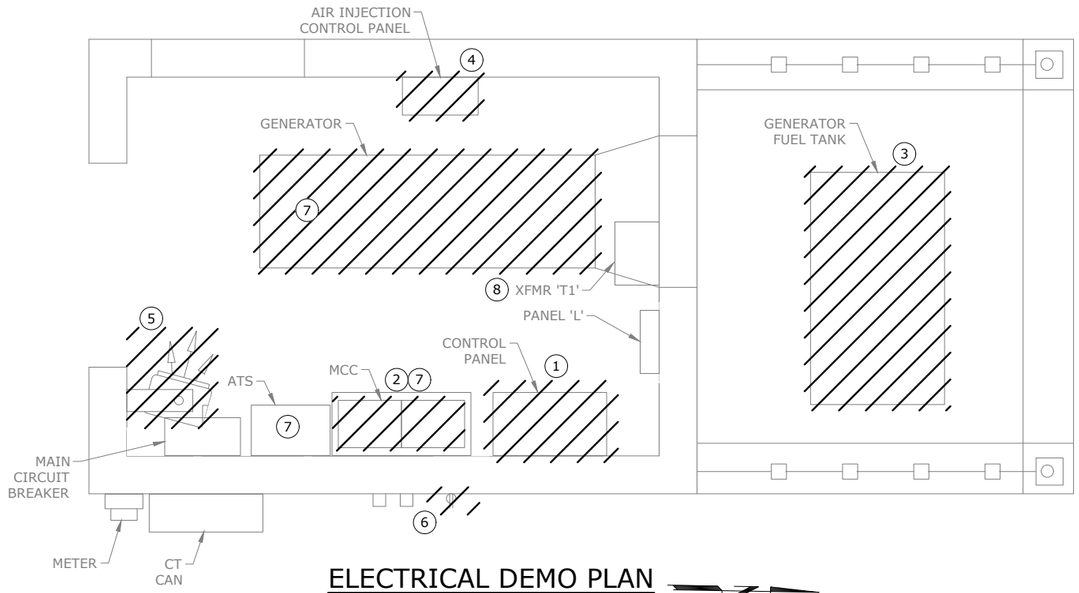
SIEBEN LANE PUMP STATION
HVAC PLAN AND SCHEDULES

consor

PROJECT: 19-2679
DATE: MAY 2025

CLACKAMAS WATER ENVIRONMENT SERVICES

G:\pdx_projects\19\2679 - clackamas county - wes - pump station rehabilitation and upgrades\CAD\Sheets\Group 2\19-2679-OR-GRP2-SCH B-H.dwg 3D-H2 5/8/2025 3:43 PM JACOB.COLES 24.1s (LMS Tech)



ELECTRICAL DEMO PLAN

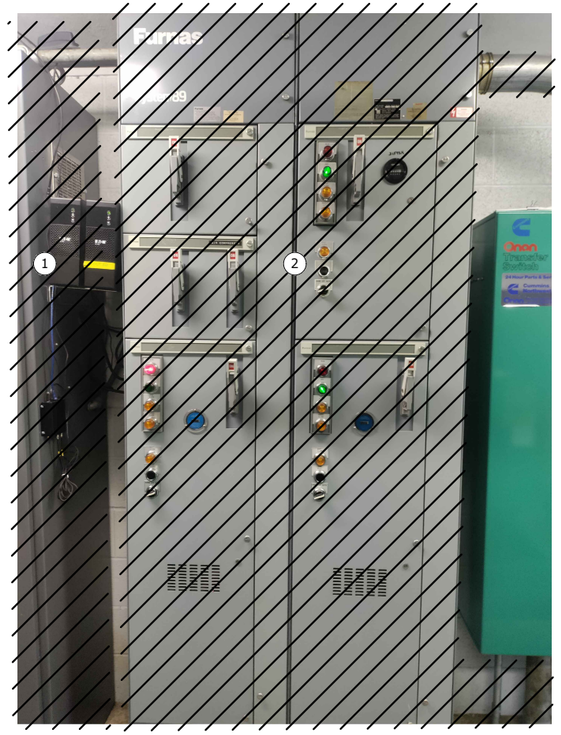
SCALE: 1/2"= 1'

GENERAL NOTES

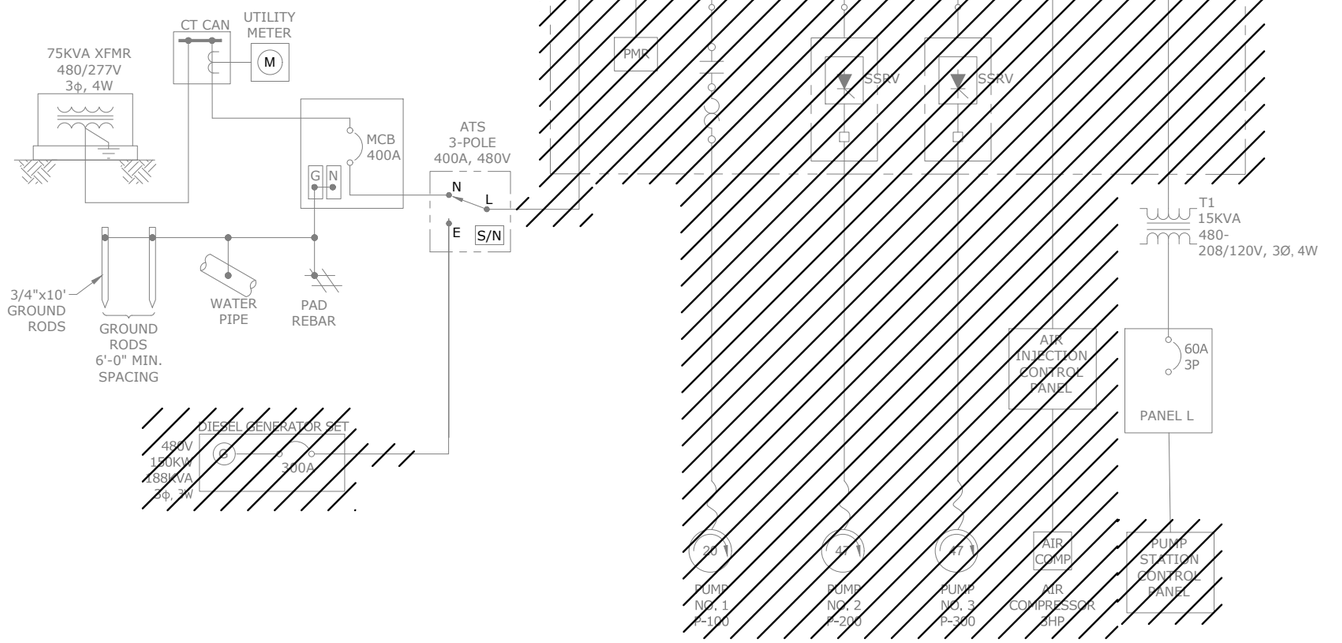
1. EXISTING CONDUCTORS CAN BE RE-USED WHEN RECONNECTING EXISTING CIRCUITS IF LONG ENOUGH TO REACH CONNECTION POINT WITHOUT SPLICING; OTHERWISE PROVIDE NEW CONDUCTORS.
2. SEAL AND PAINT EXPOSED WALL BEFORE INSTALLING NEW EQUIPMENT.
3. OWNER TO SALVAGE COMPONENTS, CONTRACTOR TO NOTIFY OWNER AFTER BYPASS PUMPING IS IN PLACE AND BEFORE DEMOLITION OCCURS.

KEY NOTES

1. EXISTING PUMP STATON CONTROL PANEL TO BE REMOVED. SEE SHEET 3D-IC16 FOR ADDITIONAL INFORMATION.
2. REMOVE EXISTING MCC, HOUSEKEEPING PAD AND ASSOCIATED CONDUITS AND CONDUCTORS.
3. CONTRACTOR TO REMOVE AND DISPOSE OF FUEL PRIOR TO DEMO OF TANK.
4. CONTRACTOR TO REMOVE AIR INJECTION CONTROL PANEL, CONDUCTORS, AND CONDUIT.
5. EXISTING UNIT HEATER TO BE DEMO'D. REMOVE EXISTING CONDUIT AND CONDUCTORS.
6. EXISTING GFCI AND CONDUIT TO BE REMOVED AND CAPPED BELOW GRADE FOR LOCATION OF NEW PUMP DISCONNECT PANEL.
7. EXISTING UNDERGROUND CONDUITS TO BE ABANDONED. CUT EXISTING CONDUIT FLUSH WITH GRADE AND FILL WITH NON-SHRINK GROUT MINIMUM 4".
8. EXISTING XFMR 'T1' TO BE RELOCATED FROM WALL MOUNTING TO FLOOR.



ELECTRICAL/CONTROL ROOM MCC ELEVATION



ONE-LINE DIAGRAM - DEMO

SCALE: NTS

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#:20.18.02

NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

SHEET 3D-E1 159 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON MAY 14, 2019 MICHAEL E. WELLS 88305PE EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ.: AS SHOWN

NOTICE 0 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
ELECTRICAL
DEMOLITION PLAN

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

P:\Projects\20.18.02_MSA_WES_Final_Design\DWG\Group 3\3D-E1-Sieben Lane.dwg 3D-E1 5/6/2025 8:54 AM ROBERTC 23.1s (LMS Tech)

LOAD SUMMARY		LOAD		
QTY.	DESCRIPTION	HP	KVA	AMPS @ 480 VAC
	MOTOR LOADS			
1	PUMP #1 MOTOR	44 HP	43.2	52.0
1	PUMP #2 MOTOR	44 HP	43.2	52.0
	OTHER LOADS			
1	DISTRIBUTION XFMR	15 KVA	15.0	18.0
	MISC 120/208V LOADS (PART OF XFMR ABOVE)			
1	SPLIT SYSTEM HEAT PUMP	2 KW	1.8	13.4
	SUBTOTAL		**103.2**	**124.1**
	LARGEST MOTOR X 25%		10.8	13.0
	NON-MOTOR LOADS X 25%		4.2	5.0
	SPARE CAPACITY (10%)		10.3	12.4
	TOTAL		**128.5**	**154.5**

LOAD SUMMARY

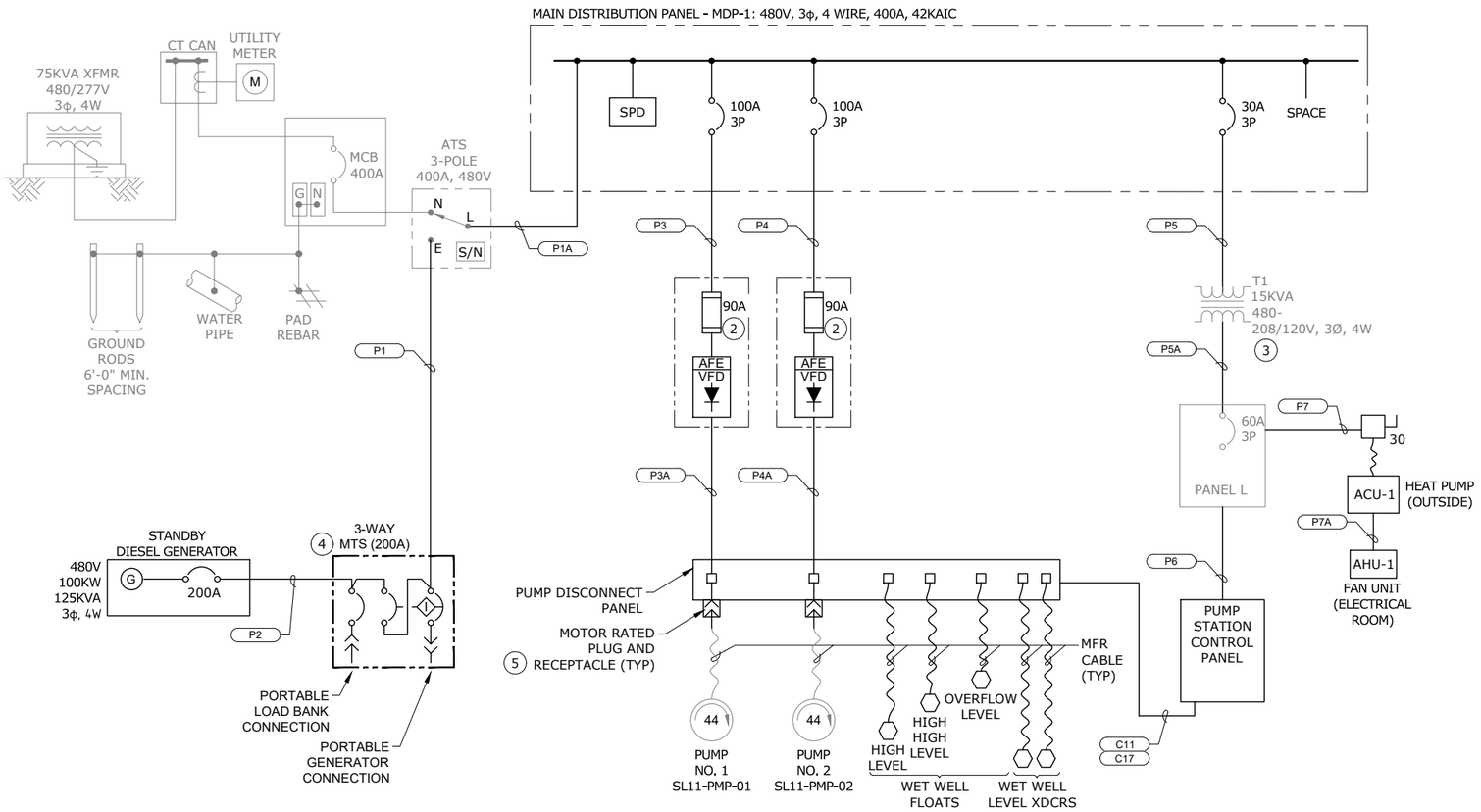
SCALE: NTS

GENERAL NOTES

1. RE-USE EXISTING CONDUITS WHERE POSSIBLE AND EXTEND TO PANELS WHERE NEEDED.
2. EXISTING CONDUCTORS CAN BE RE-USED IF LONG ENOUGH TO REACH CONNECTION POINT WITHOUT SPLICING; OTHERWISE PROVIDE NEW CONDUCTORS.
3. CONTRACTOR TO REPLACE ALL GENERAL PURPOSE RECEPTACLES WITH NEW GFCI PROTECTED UNITS. APPROXIMATELY 5 IN TOTAL.

KEY NOTES

1. PROVIDE WARNING SIGN READING "UTILITY SERVICE DISCONNECT DOES NOT DISCONNECT GENERATOR".
2. VERIFY SIZE WITH MANUFACTURER OF VARIABLE FREQUENCY DRIVE PROVIDED.
3. EXISTING TRANSFORMER TO BE RELOCATED FROM WALL TO FLOOR.
4. 3-WAY MANUAL TRANSFER SWITCH WITH CAM-LOCK CONNECTORS.
5. CONTRACTOR TO INSTALL NEW PLUGS AND RECEPTACLES ON EXISTING PUMP MANUFACTURERS CABLING FOR CONNECTION TO NEW PUMP DISCONNECT PANEL.



ONE-LINE DIAGRAM - MODIFIED

SCALE: NTS

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO. | DATE | REVISION | BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

SHEET 3D-E2 160 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MICHAEL E. WELLS MAY 14, 2026 EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ.: AS SHOWN

NOTICE IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 – 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
ELECTRICAL
ONE-LINE DIAGRAM

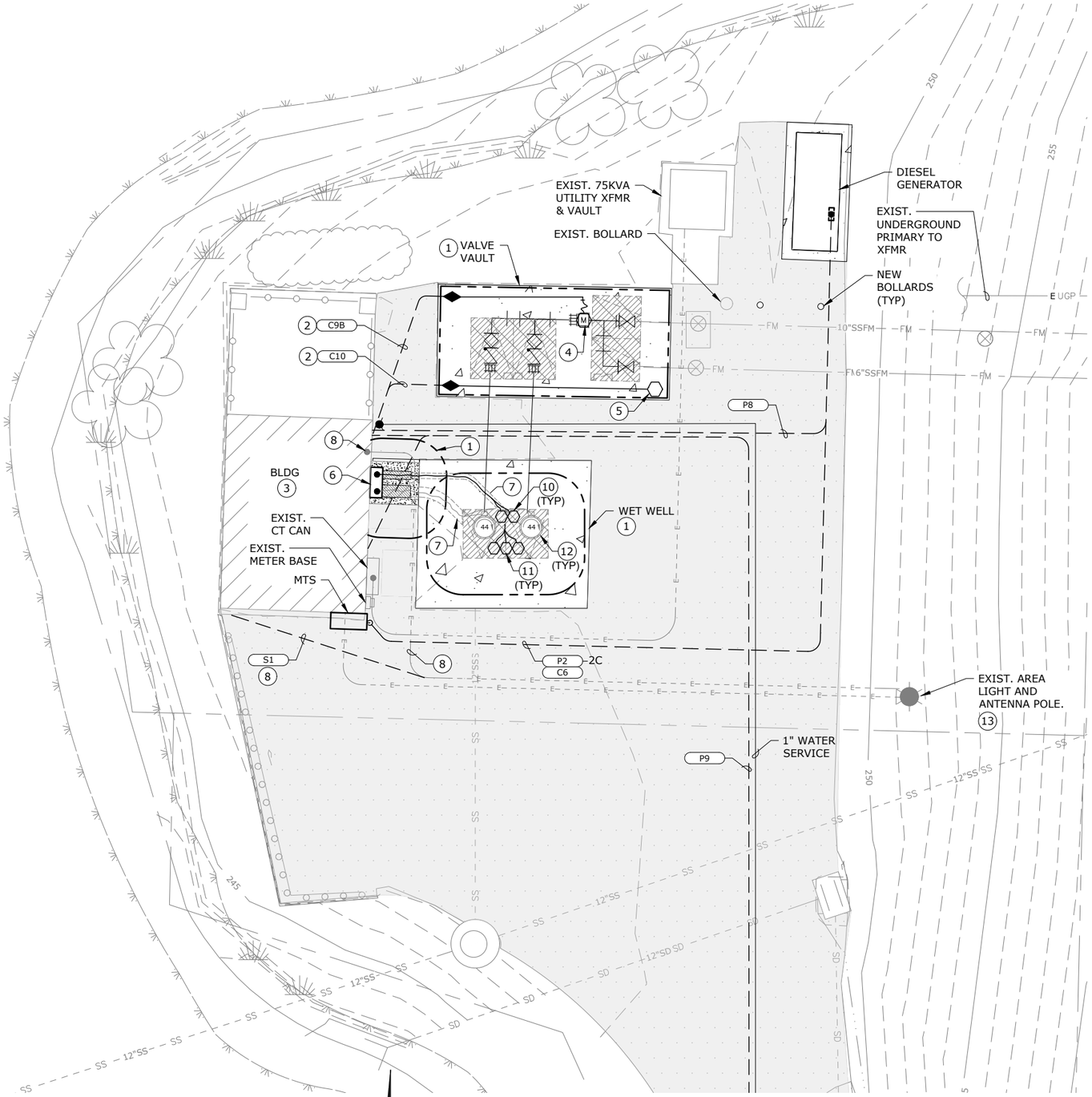
consor

DATE: MAY 2025

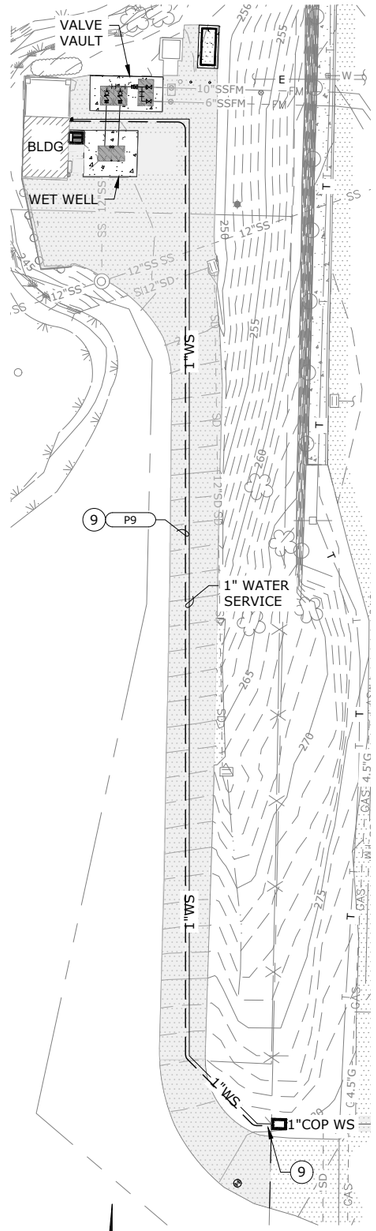
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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ELECTRICAL PLAN
SCALE: 1"= 5'



RPBA PLAN
SCALE: 1"= 20'

GENERAL NOTES

1. VERIFY ALL UNDERGROUND CONDUITS. CONDUIT LOCATIONS SHOWN ARE FROM RECORD AS-BUILTS AND HAVE NOT BEEN VERIFIED FOR ACCURACY.
2. CONTRACTOR TO PAY SPECIAL ATTENTION TO EXISTING UNDERGROUND PRIMARY UTILITY POWER ROUTING WHEN INSTALLING NEW CONDUITS.
3. SEE SHEET 3-GD6 FOR TYPICAL CONDUIT TRENCHES AND TRANSITION.

KEY NOTES

(1) CLASS 1 DIV. 2 GROUP D SPACE IN AN ENVELOPE 18" ABOVE GRADE 3' LATERALLY FROM TRENCH AND SLEEVE OPENINGS FOR WETWELL AND CLASS 1 DIV. 2 GROUP D SPACE INSIDE OF VALVE VAULT. INTERIOR OF WETWELL IS CLASS 1 DIV. 1 GROUP D SPACE

(2) CONDUITS ARE ENTERING HAZARDOUS AREA; PROVIDE TRANSITION 12" OUTSIDE VAULT FROM PVC TO RGS TO MAINTAIN CONTINUOUS CONDUITS TO SEAL OFFS.

(3) SEE SHEET 3D-E4 FOR BUILDING ELECTRICAL EQUIPMENT CONNECTION PLAN.

(4) FLOWMETER TUBE FIT-1008. ROUTE NEW CONDUIT ALONG WALL AND FLEX FOR FINAL CONNECTION TO TUBE FOR CLEAN APPEARANCE.

(5) VALVE VAULT FLOOD SWITCH LSH-1009. SEE DETAIL 6 SHEET 3-GD6

(6) PUMP DISCONNECT PANEL WITH PUMP RECEPTACLES AND PLUGS. SEE SHEET 3D-E9.

(7) PUMP CABLING TRENCH WITH PIPE SLEEVE FOR ROUTING OF PUMP AND LEVEL CONTROLS MANUFACTURER'S CABLES. SEE SHEET 3D-M1 AND 3D-M2.

(8) INTERCEPT EXISTING ANTENNA COAX CABLE CONDUIT AND REROUTE TO CORNER OF BUILDING IF UNABLE TO REUSE EXISTING CONDUIT RUN INTERIOR TO BUILDING BECAUSE OF NEW EQUIPMENT INSTALL.

(9) RPBA HOT BOX GFCI RECEPTACLE FOR CONNECTION OF SELF REGULATING HEAT TRACE. SEE SHEET 2-GD6. USE LONG RADIUS SWEEP ELBOWS FOR ROUTING OF CONDUIT.

(10) WET WELL LEVEL SENSORS, PT-1001 & PT-1002 IN STILLING WELLS. SEE SHEET 3D-M1, 3D-M2 AND 3-GD6 FOR LOCATION AND INSTALLATION INFORMATION.

(11) FLOAT SWITCHES, LSH-1010, LSHH-1010, LSHH-1011 IN WET WELL. SEE SHEET 3D-M1, 3D-M2 AND 3-GD6 FOR LOCATION AND INSTALLATION INFORMATION.

(12) EXISTING SUBMERSIBLE PUMPS WITH MFR CABLING ROUTED TO PUMP DISCONNECT PANEL VIA CABLE TRENCH AND SLEEVES.

(13) REPLACE EXISTING LUMINAIRE ON POLE WITH "B" LUMINAIRE. SEE LUMINAIRE SCHEDULE SHEET 3D-E10.

NO.	DATE	REVISION	BY

SHEET 3D-E3
161 of 184

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

REGISTERED PROFESSIONAL ENGINEER
OREGON
88305PE
MAY 14, 2010
MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE: VERT.: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
ELECTRICAL
SITE PLAN

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

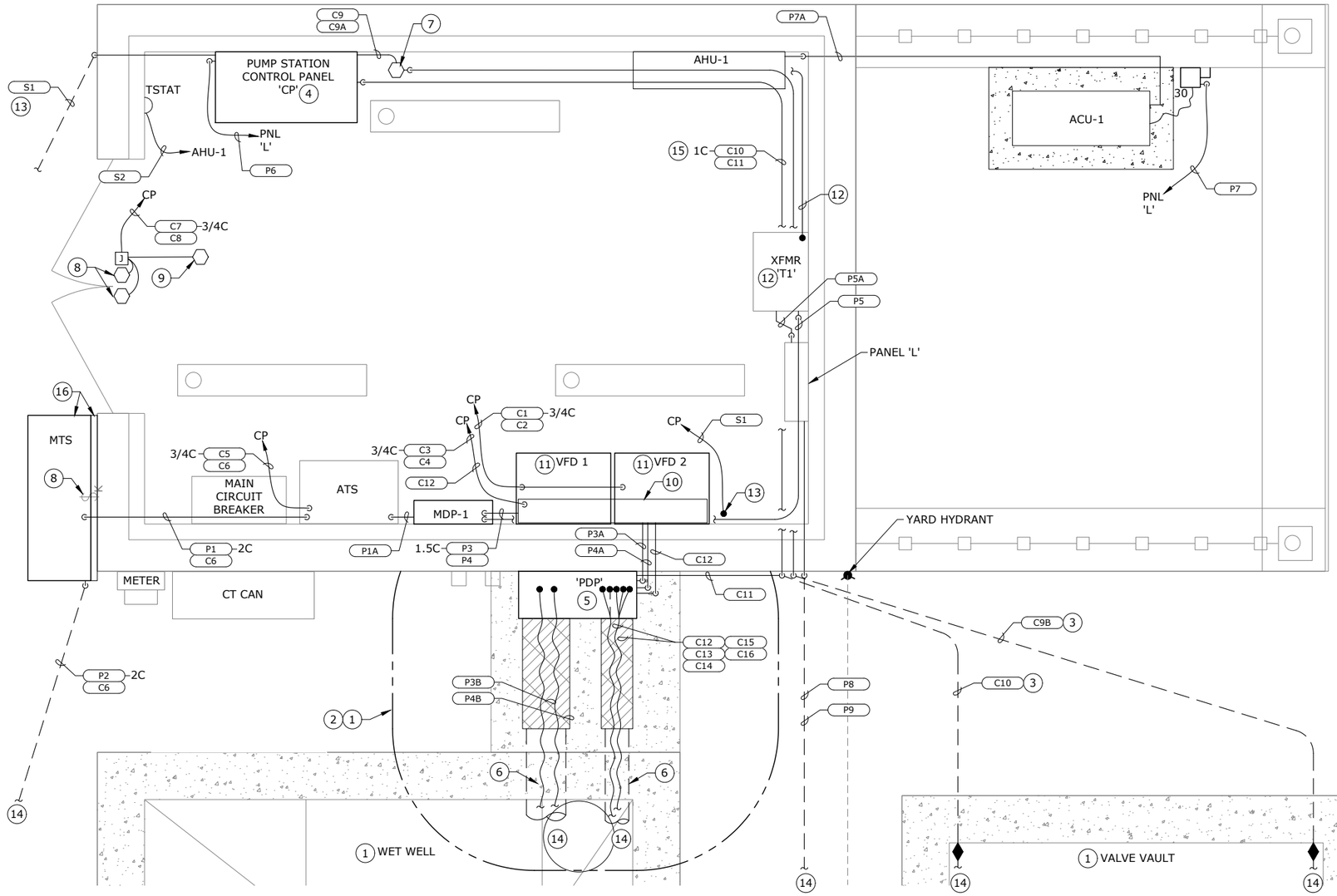
P:\Projects\20.18.02_MSA_WES_Final_Design\DWG\Group 3\3D-E3-Sieben Lane.dwg 3D-E3 5/6/2025 9:51 AM ROBERTC 23.1s (LMS Tech)

KEY NOTES

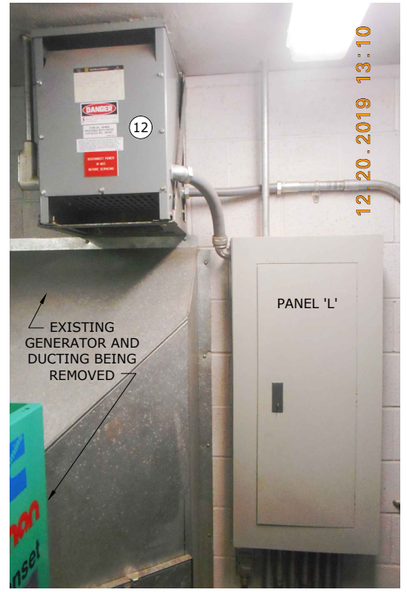
1. CLASS 1 DIV. 2 GROUP D SPACE IN AN ENVELOPE 18" ABOVE GRADE 3' LATERALLY FROMTRENCH AND SLEEVE OPENINGS FOR WETWELL AND CLASS 1 DIV. 2 GROUP D SPACE INSIDE OF VALVE VAULT. INTERIOR OF WETWELL IS CLASS 1 DIV. 1 GROUP D SPACE
2. IF ANY CONDUITS ARE ROUTED THROUGH THIS AREA AT GRADE, THEY MUST BE CONTINUOUS FROM BELOW GRADE TO A MINIMUM OF 18" ABOVE GRADE.
3. CONDUITS ARE ENTERING HAZARDOUS AREA; PROVIDE TRANSITION 12" OUTSIDE VAULT FROM PVC TO RGS TO MAINTAIN CONTINUOUS CONDUITS TO SEAL OFFS.
4. CONDUIT ENTRIES TO BE FROM SIDE OF PANEL. NO TOP ENTRIES.
5. PUMP DISCONNECT PANEL WITH PUMP RECEPTACLES AND PLUGS. CONDUIT ENTRIES TO BE FROM SIDE OF PANEL. NO TOP ENTRIES. SEE SHEET 3D-E9.
6. PUMP CABLING TRENCH WITH PIPE SLEEVE FOR ROUTING OF PUMP AND LEVEL CONTROLS MANUFACTURER'S CABLES. SEE SHEET 3D-M5.
7. FLOWMETER ELECTRONICS FIT-1008 WALL MOUNT NEAR CONTROL PANEL.
8. EXISTING INTRUSION SWITCHES TO BE REPLACED WITH NEW AND RECONNECTED TO NEW CONTROL PANEL. REMOVE EXISTING KEYSWITCH AND WIRING FROM INTRUSION BYPASS CIRCUIT. REMOVE CONDUIT FROM REMOVED KEYSWITCH TO GFCI BELOW TO ALLOW SPACE FOR MTS AND INSTALL CONDUIT HOLE PLUG TO CAP OPENING.
9. CEILING MOUNT NEW SMOKE DETECTOR AND CONNECT TO NEW CONTROL PANEL.
10. INSTALL NEW WIREWAY FOR USE IN ROUTING CONDUCTORS FOR CONNECTION OF VFD POWER, VFD SIGNAL CIRCUITS AND PUMP POWER TO DISCONNECT PANEL. **DO NOT** ROUTE VFD ETHERNET CABLING THROUGH WIREWAY.
11. VFD CABINETS. SEE SHEETS 3D-E7 & 3D-E8.
12. EXISTING WALL MOUNTED TRANSFORMER TO BE RELOCATED TO FLOOR. RE-ROUTE BONDING CONDUCTOR ALONG WALL TO EXISTING SERVICE BONDING CONNECTION AT WATER PIPING (BEING REMOVED) ON WEST WALL. CONNECT AND VERIFY CONNECTION TO GROUNDING ELECTRODE SYSTEM. CUT EXISTING CONDUIT AT CEILING AND PATCH. REMOVE EXISTING BONDING CONDUCTOR AND CONDUIT ON WEST WALL AT COUPLING AT CEILING. FIELD VERIFY CONDUIT. SEE TRANSFORMER DETAIL AT RIGHT.
13. IF THE EXISTING COAX CONDUIT TO THE DEMO'D CONTROL PANEL IS ACCESSIBLE AFTER LOCATING THE NEW EQUIPMENT, THE CONTRACTOR MAY RE-USE IT TO ROUTE THE NEW ANTENNA COAX TO THE NEW CONTROL PANEL. OTHERWISE CONTRACTOR TO INTERCEPT EXISTING CONDUIT IN THE YARD AREA AND REROUTE TO SOUTHWEST BUILDING CORNER AND INTO EXISTING CONTROL PANEL. SEE SHEET 3D-E3.
14. SEE SHEET 3D-E3 FOR CONTINUATION AND 3D-M3 FOR ADDITIONAL INFORMATION.
15. CONDUIT CONTAINS INTRINSICALLY SAFE CONDUCTORS. ENSURE SEPARATION OF CONDUCTORS FROM NON INTRINSICALLY SAFE CONDUCTORS PER NEC AND ENTER PANEL IN INTRINSIC SAFE DESIGNATED AREA.
16. 3-WAY MANUAL TRANSFER SWITCH. UNIT WILL OVERHANG RIGHT SIDE EDGE OF WALL BY A COUPLE OF INCHES, INSTALL STRUT OR BACKPLATE TO BUILDING FOR ADDITIONAL STRUCTURAL MOUNTING.

GENERAL NOTES

1. SEE IC SHEETS FOR ADDITIONAL CONNECTION INFORMATION.
2. CONTRACTOR TO REPLACE ALL GENERAL PURPOSE RECEPTACLES WITH NEW GFCI PROTECTED UNITS. APPROXIMATELY 5 IN TOTAL.
3. SEAL ALL CONDUIT PENETRATIONS, WATER-PROOF, FROM EXTERIOR TO INTERIOR OF BUILDING WITH NON-SHRINK GROUT.
4. PURSUENT TO OCEC SECTION 9.4.1.1 EXCEPTION (H), THE INTERIOR LIGHTING IS EXEMPT FROM AUTOMATED LIGHTING CONTROLS TO ENSURE SAFETY OF OPERATIONS PERSONNEL.



ELECTRICAL EQUIPMENT PLAN
SCALE: 3/4"= 1'



TRANSFORMER DETAIL
SCALE: NONE

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NO.	DATE	REVISION	BY

SHEET 3D-E4 162 of 184

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

REGISTERED PROFESSIONAL ENGINEER
OREGON
88305PE
MAY 14, 2004
MICHAEL E. WILLIS
EXPIRES: 6/30/26

SCALE: VERT.: AS SHOWN HORIZ: AS SHOWN
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
ELECTRICAL
EQUIPMENT CONNECTIONS PLAN

consor

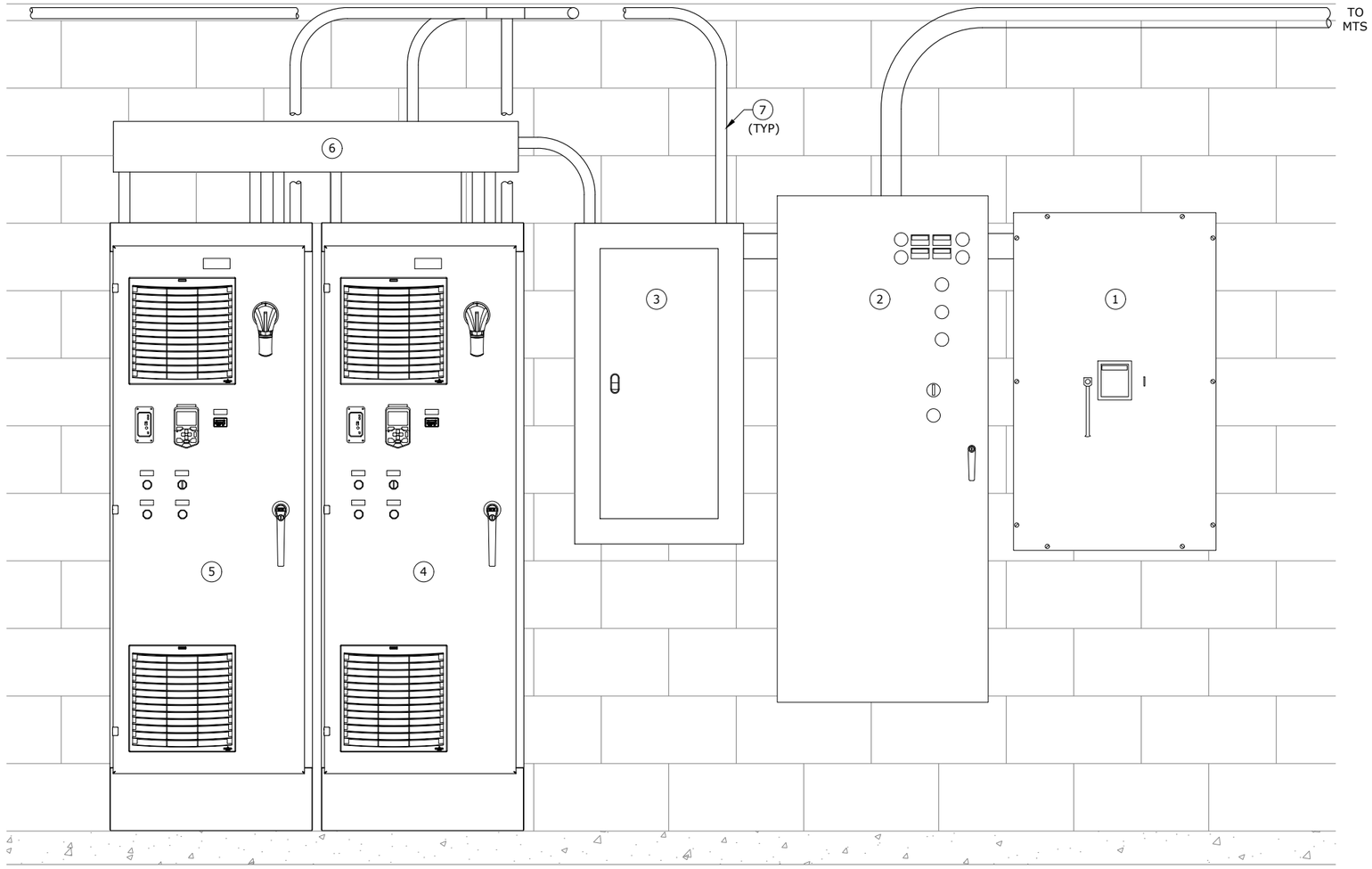
DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: ie@industrialsystems-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

KEY NOTES

1. EXISTING 400A MAIN CIRCUIT BREAKER.
2. EXISTING 400A AUTOMATIC TRANSFER SWITCH
3. NEW 400A MAIN DISTRIBUTION PANEL "MDP-1"
4. NEW VFD CONTROL PANEL "VFD 1"
5. NEW VFD CONTROL PANEL "VFD 2"
6. NEW WIREWAY, 6x6 OR AS REQUIRED.
7. NEW CONDUITS AS NEEDED. SEE SHEET 3D-E4.



ELECTRICAL EQUIPMENT SECTION
SCALE: NTS

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NO.	DATE	REVISION	BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

SHEET 3D-E5
163 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
88305PE
MAY 14, 2025
MICHAEL E. WALLS
EXPIRES: 6/30/26

SCALE
VERT: AS SHOWN
HORIZ: AS SHOWN

NOTICE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
ELECTRICAL
EQUIPMENT CONNECTION SECTIONS

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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ALL CIRCUITS ARE IDENTIFIED ON THE PLANS WITH THE DIAMOND SYMBOL. CONDUCTOR SIZES ARE BASED ON COPPER CONDUCTORS. CONDUIT SIZES ARE SHOWN FOR CASES WHEN CIRCUIT CONDUCTORS ARE RUN WITHOUT OTHER CIRCUITS. MULTIPLE CIRCUITS RUN IN COMMON CONDUITS ARE SHOWN ON PLANS AND SUPERSEDE THE BASIC CONDUIT SIZE SHOWN.

RACEWAY SIZES ARE IN INCHES WITH QUANTITIES IN EXCESS OF (1) SHOWN IN ADJACENT PARENTHESIS. CONDUCTOR CONFIGURATIONS ARE CODED AS FOLLOWS: P- FOR POWER CONDUCTORS, G - FOR GROUND CONDUCTORS, N - FOR NEUTRAL CONDUCTORS, C - FOR CONTROL CONDUCTORS, TSP - FOR TWISTED SHIELDED PAIR, AND SP - FOR SPARE CONDUCTORS.

CIRCUITS REVISED SINCE LAST ISSUE ARE INDICATED BY AN ASTERISK(*).

CIRCUIT NUMBER	FROM	TO	CONDUCTORS	RACEWAY	NOTES
P1	EXISTING ATS	3-WAY MANUAL TRANSFER SWITCH (MTS)	(3) 3/0 AWG, P (1) 3/0 AWG, N (1) 6 AWG, G (2) 14 AWG, C (2) 14 AWG, SP	2	POWER START SIGNAL. SEE CKT C6 FOR FOR GEN SIGNALS ROUTED IN SAME CONDUIT
P1A	EXISTING ATS	MDP-1	(6) 3/0 AWG, P (2) 3/0 AWG, N (1) 6 AWG, G	3 NIPPLE	
P2	3-WAY MANUAL TRANSFER SWITCH (MTS)	GENERATOR	(3) 3/0 AWG, P (1) 3/0 AWG, N (1) 6 AWG, G (2) 14 AWG, C (2) 14 AWG, SP	2	POWER START SIGNAL. SEE CKT C6 FOR FOR GEN SIGNALS ROUTED IN SAME CONDUIT
P3	MDP-1	VFD 1	(3) 3 AWG, P (1) 8 AWG, G	1	(VIA WIREWAY)
P3A	VFD 1	PUMP DISCONNECT PANEL (PDP)	(3) 4 AWG, P (2) 14 AWG, C (1) 8 AWG, G	1	PUMP 1 POWER PUMP THERMAL/LEAK CKT (VIA WIREWAY)
P3B	PUMP DISCONNECT PANEL (PDP)	PUMP 1	MFR CABLE	TRENCH	
P4	MDP-1	VFD 2	(3) 3 AWG, P (1) 8 AWG, G	1	(VIA WIREWAY)
P4A	VFD 2	PUMP DISCONNECT PANEL (PDP)	(3) 4 AWG, P (1) 18 AWG, TSP (1) 8 AWG, G	1	PUMP 2 POWER PUMP THERMAL/LEAK CKT (VIA WIREWAY)
P4B	PUMP DISCONNECT PANEL (PDP)	PUMP 2	MFR CABLE	TRENCH	
P5	MDP-1	EXISTING XMFR "T1"	(3) 10 AWG, P (1) 10 AWG, G	3/4	
P5A	EXISTING XMFR "T1"	EXISTING PANEL "L"	(3) 4 AWG, P (1) 4 AWG, N (1) 8 AWG, G	1.25	
P6	EXISTING PANEL "L"	PUMP STATION CONTROL PANEL	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
P7	EXISTING PANEL "L"	AIR CONDENSER UNIT ACU-1	(2) 12 AWG, P (1) 12 AWG, G	3/4	ROUTE VIA DISCONNECT SWITCH
P7A	AIR CONDENSER UNIT ACU-1	AIR HANDLING UNIT AHU-1	(3) 14 AWG, P (1) 14 AWG, G	3/4	VERIFY CONDUCTOR SIZE AND COUNT WITH MANUFACTURER
P8	EXISTING PANEL "L"	GENERATOR	(2) 12 AWG, P (2) 12 AWG, N (1) 12 AWG, G	3/4	BLOCK HTR / BATTERY CHGR CKT
P9	EXISTING PANEL "L"	RPBA HOT BOX	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	1	
P10	EXISTING SWITCH BOX	NEW EXTERIOR BUILDING LUMINAIRE	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4	
C1	PUMP STATION CONTROL PANEL	VFD 1	CAT 6E	3/4	**DO NOT ROUTE VIA WIREWAY**
C2	PUMP STATION CONTROL PANEL	VFD 2	CAT 6E	3/4	**DO NOT ROUTE VIA WIREWAY**
C3	PUMP STATION CONTROL PANEL	VFD 1	(7) 14 AWG, C (2) 14 AWG, SP (1) 14 AWG, G	3/4	(VIA WIREWAY)
C4	PUMP STATION CONTROL PANEL	VFD 2	(7) 14 AWG, C (2) 14 AWG, SP (1) 14 AWG, G	3/4	(VIA WIREWAY)
C5	PUMP STATION CONTROL PANEL	ATS	(4) 14 AWG, C (1) 14 AWG, G	3/4	ATS POS SIGNALS
C6	PUMP STATION CONTROL PANEL	GENERATOR	(4) 14 AWG, C (1) 14 AWG, G	3/4	RUN & FAULT SIGNALS ROUTE W/ CKT C5 TO ATS AND CKTS P1 AND P2 TO GEN
C7	PUMP STATION CONTROL PANEL	INTRUSION SWITCHES	(4) 14 AWG, C (1) 14 AWG, G	3/4	
C8	PUMP STATION CONTROL PANEL	SMOKE DETECTOR	(2) 14 AWG, C (2) 14 AWG, C	3/4	DC POWER SIGNAL CKT
C9	PUMP STATION CONTROL PANEL	FLOWMETER ELECTRONICS	(1) 14 AWG, P (1) 14 AWG, N (1) 14 AWG, G	1/2	AC UNIT POWER
C9A	PUMP STATION CONTROL PANEL	FLOWMETER ELECTRONICS	(1) 18 AWG, TSP	3/4	4-20MA FLOW SIGNAL
C9B	FLOWMETER ELECTRONICS	FLOWTUBE	(2) MFR CABLES	1	MFR COIL & ELECTRODE CABLE
C10	PUMP STATION CONTROL PANEL	VALVE VAULT FLOOD SWITCH	(2) 14 AWG, C (1) 14 AWG, G	1	RUN INTERIOR TO CP W/CKT C11 (INSTRINSIC SAFE - KEEP SEPARATE)
C11	PUMP STATION CONTROL PANEL	PUMP DISCONNECT PANEL (PDP)	(2) 18 AWG, TSP (6) 14 AWG, C (1) 14 AWG, G	1	NEW LEVEL SENSOR CABLES LO, HI, & HI-HI FLOATS (INSTRINSIC SAFE - KEEP SEPARATE)
C12	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL SENSOR 1	MFR CABLE	TRENCH	
C13	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL SENSOR 2	MFR CABLE	TRENCH	
C14	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL HIGH FLOAT	MFR CABLE	TRENCH	
C15	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL HIGH HIGH FLOAT	MFR CABLE	TRENCH	
C16	PUMP DISCONNECT PANEL (PDP)	WET WELL LEVEL OVERFLOW FLOAT	MFR CABLE	TRENCH	
C17	PUMP DISCONNECT PANEL (PDP)	PUMP DISCONNECT PANEL (PDP)	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	3/4"	
S1	PUMP STATION CONTROL PANEL	EXIST. ANTENNA @ EXISTING LIGHT POLE	COAX CABLE	1.5	INTERCEPT AND RE-ROUTE TO NEW PANEL LOCATION. VERIFY CONDUIT SIZE AND COAX TYPE.
S2	AIR HANDLING UNIT AHU-1	T-STAT	(3) 14 AWG, C (1) 14 AWG, G	1/2	VERIFY CONDUCTOR SIZE AND COUNT WITH MANUFACTURER

CIRCUIT SCHEDULE

SCALE: NTS

KEY NOTES

1. EXISTING BUBBLER CONTROL PANEL CIRCUIT BREAKER TO BE RE-PURPOSED FOR CONNECTION OF NEW CONTROL PANEL.
2. REMOVE CONDUCTORS FOR CIRCUIT 7 AND BREAKER TO BECOME SPARE. EXISTING HEATER IS BEING REMOVED.
3. REMOVE CONDUCTORS FOR CIRCUIT 8; EXISTING EAST WALL RECEPTACLE IS BEING REMOVED. RE-USE BREAKER FOR CONNECTION OF NEW BATTERY CHARGER CIRCUIT.
4. REMOVE CONDUCTORS FOR CIRCUIT 11; EXISTING LOUVERS ARE BEING REMOVED. RE-USE BREAKER FOR CONNECTION OF NEW RPBA HOT BOX GFCI RECEPTACLE.
5. REMOVE CONDUCTORS FOR CIRCUIT 14 AND BREAKER TO BECOME SPARE. EXISTING HIGH WETWELL CIRCUIT IS BEING REMOVED.
6. INSTALL NEW 15A-2P BREAKER FOR CONNECTION OF NEW HVAC ACU-1 UNIT.

PANEL: L (EXISTING)	VOLTAGE: 208/120, 3PH, 4 WIRE		MOUNTING: SURFACE
LOCATION: ELECTRICAL ROOM	BUS: 125A COPPER		AIC: 10,000
FEEDER: SEE POWER RISER	MAIN: 60A		

	CKT NO	CIRCUIT DESCRIPTION	BREAKER POLES	BREAKER AMPS	VA	PHASE	LOAD VA	BREAKER POLES	BREAKER AMPS	CIRCUIT DESCRIPTION	CKT NO	
(1)	1	PLC CONTROL PANEL	1	20	500	A	200	1	20	TANK ROOM LIGHTING	2	
	3	RECEPTACLES	1	20	360	B	180	1	20	TANK AREA RECEPTACLE	4	
	5	FRONT DOOR OUTSIDE GFCI RECEPTACLES	1	20	360	C	1500	1	20	GENERATOR BLOCK HEATER	6	
(2)	7	SPARE	2	20	-	A	300	1	20	GENERATOR BATTERY CHARGER	8	(3)
	9	SPARE	-	20	-	B	-	1	20	SPARE	10	
(4)	11	HOT BOX GFCI	1	20	60	C	-	1	20	SPARE	12	
	13	AREA LIGHTING	1	20	250	A	-	1	20	SPARE	14	(5)
	15	INTERIOR LIGHTING	1	20	300	B	1133.6	2	15	HVAC AIR CONDENSER UNIT ACU-1	16	(6)
	17	SPARE	1	20	-	C	1133.6	-	15	"	18	
	19	SPARE	1	20	-	A	-	1	20	SPARE	20	
	21	SPARE	1	20	-	B	-	1	20	SPARE	22	
	23	SPARE	1	20	-	C	-	1	20	SPARE	24	
	25	SPARE	1	20	-	A	-	1	20	SPARE	26	
	27	SPARE	1	20	-	B	-	1	20	SPARE	28	
	29	SPARE	1	20	-	C	-	1	20	SPARE	30	
	31	SPARE	1	20	-	A	-	1	20	SPARE	32	
	33	SPARE	1	20	-	B	-	1	20	SPARE	34	
	35	SPARE	1	20	-	C	-	1	20	SPARE	36	
	37	SPARE	1	20	-	A	-	1	20	SPARE	38	
	39	SPARE	1	20	-	B	-	1	20	SPARE	40	
	41	SPARE	1	20	-	C	-	1	20	SPARE	42	

LOAD PER PHASE

PHASE A	1.3	KVA
PHASE B	2.0	KVA
PHASE C	3.1	KVA
TOTAL LOAD	6.3	KVA
TOTAL AMPS	17	AMPS

PANEL SCHEDULE

SCALE: NTS

Industrial Systems INC
12119 NE 99th Street
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OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO. | DATE | REVISION | BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

SHEET 3D-E6 164 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON MAY 14, 2015 MICHAEL E. WEST 88305PE
EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ: AS SHOWN

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
ELECTRICAL
CIRCUIT AND PANEL SCHEDULE

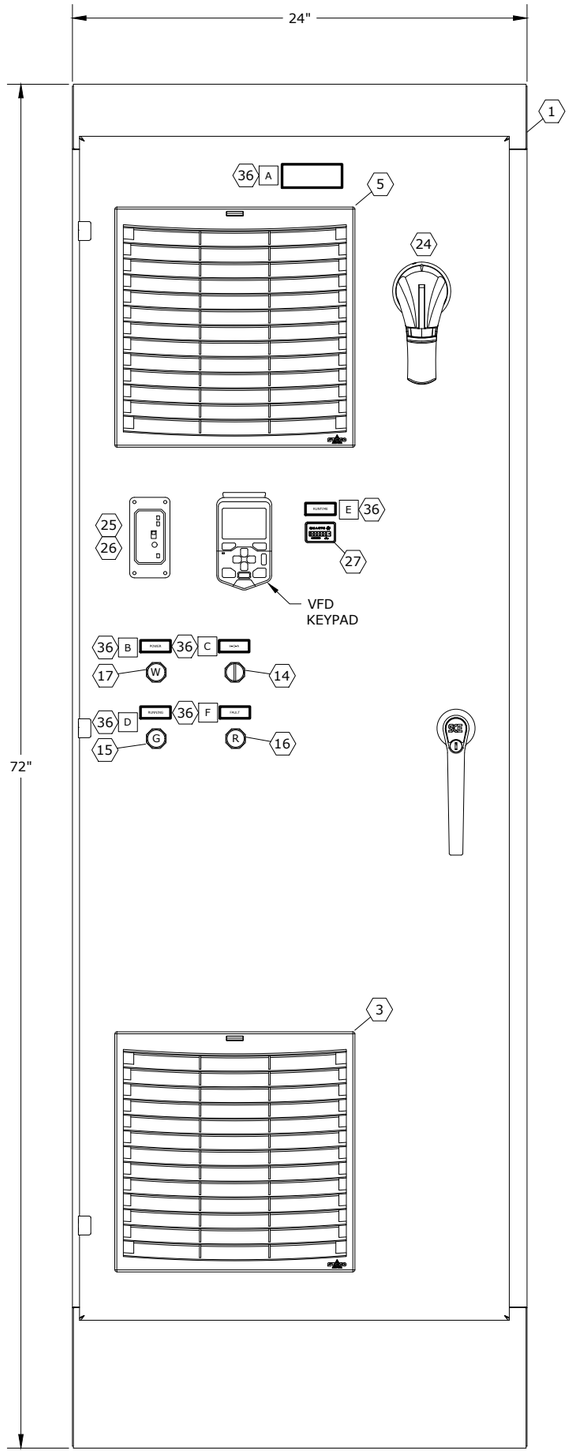
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DATE: MAY 2025

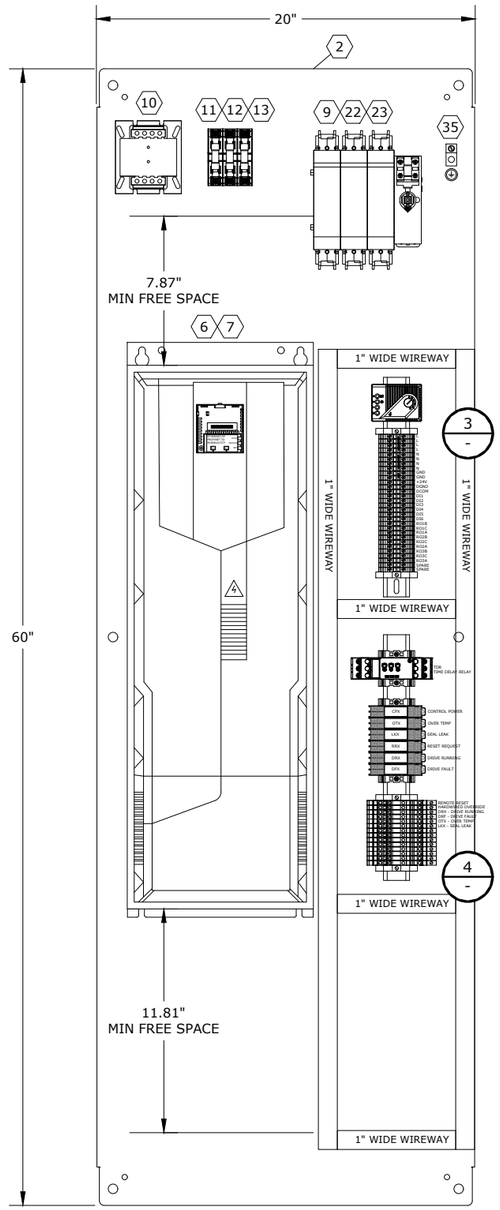
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

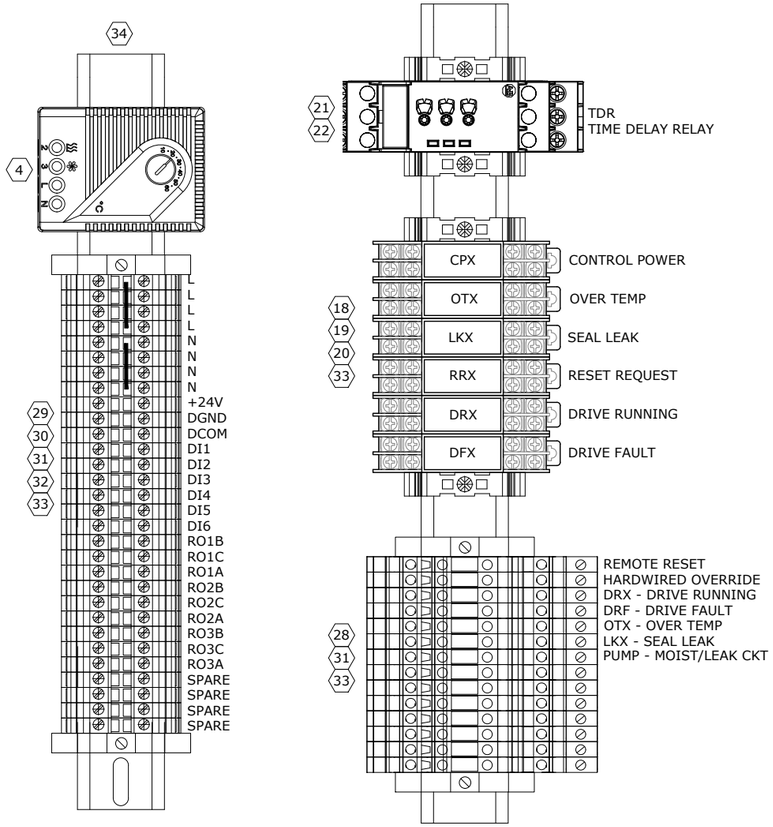
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VFD ENCLOSURE LAYOUT (1 / -)
SCALE: 1/4" = 1'-0"



VFD BACKPANEL LAYOUT (2 / -)
SCALE: 1/4" = 1'-0"



DRIVE CONNECTION TERMINAL LAYOUT (3 / -)
SCALE: NTS

RELAY AND TERMINAL LAYOUT (4 / -)
SCALE: NTS

NAMEPLATE SCHEDULE

A

ITEM	NAMEPLATE SCHEDULE
A	SL11-PMP-0X (X=1-2)
B	POWER
C	H/O/A/
D	RUNNING
E	RUNTIME
F	FAULT

GENERAL NOTES

1. PROVIDE FOUR (4) SPARE COOLING FAN FILTERS.
2. PANEL LAYOUT IS CONCEPTUAL AND FINALIZED LAYOUT SHALL BE PER UL 508 REQUIREMENTS AND PROVIDED BY MANUFACTURER.
3. PANEL IS TYPICAL FOR 2 UNITS, VFD-1 (SL11-PMP-01) AND VFD-2 (SL11-PMP-02).

BILL OF MATERIALS

#

ITEM	MANUFACTURER	PART NUMBER	DESCRIPTION
1	SAGINAW	SCE-72EL2418FS	ENCLOSURE, 72 x 24 x 18, FLOORSTANDING, SINGLE DOOR, NEMA 12
2	SAGINAW	SCE-72P24F1	BACKPANEL, 72 x 24
3	STEGO	018849-00	FILTER FAN GRAY 115VAC 414 CFM
4	STEGO	011709-00	THERMOSTAT CONTROLLER, 115VAC, FAHRENHEIT
5	STEGO	0118840-30	EXHAUST GRILLE GRAY
6	ABB	ACQ-580-31-065A-4	50HP VFD WITH ACTIVE HARMONIC FRONT END
7	ABB	FPNO-21-KIT	PROFINET ADAPTER
8	NOT USED	-	-
9	BUSSMANN	JJS-90	FAST ACTING, CURRENT LIMITING CLASS T 200kAIC @ 600V
10	ALLEN BRADLEY	1497-A-BASX-0-N	CONTROL TRANSFORMER
11	ALLEN BRADLEY	1491-R171	FUSE BLOCK CLASS CC 0-30A 3 POLE
12	MERSEN	ATDR1/4	CLASS CC FUSE - PRIMARY - 1/4 AMP
13	MERSEN	ATDR8/10	CLASS CC FUSE - SECONDARY - 8/10 AMP
14	ALLEN BRADLEY	800T-J2B	3 POSITION SELECTOR SWITCH
15	ALLEN BRADLEY	800T-QTH2G	PUSH-TO-TEST, LED, PILOT LIGHT - GREEN
16	ALLEN BRADLEY	800T-QTH2R	PUSH-TO-TEST, LED, PILOT LIGHT - RED
17	ALLEN BRADLEY	800T-QTH2W	PUSH-TO-TEST, LED, PILOT LIGHT - WHITE
18	IDEC	RJ2S-CL-A120	2PDT CONTROL RELAY, 120VAC
19	IDEC	RJ2S-CL-D24	2PDT CONTROL RELAY, 24VDC
20	IDEC	RJ2S-05BW	2PDT CONTROL RELAY BASE
21	ALLEN BRADLEY	700-FSM78UU23	GENERAL PURPOSE TIMING RELAY, MULTI FUNCTION
22	SOCOMEC	38613010	100A FUSED DISCONNECT SWITCH
23	SOCOMEC	14001040	DISCONNECT SHAFT
24	SOCOMEC	142G2111	2-POS, LOCKABLE ROTARY HANDLE
25	FLYGT	14-407129	MINICAS 120 PUMP MOISTURE/TEMPERATURE RELAY
26	OMRON	P3GA-11	MINICAS 120 PUMP MOISTURE/TEMPERATURE REVERSE RELAY BASE
27	TRUMETER	722-0002	6-DIGIT HOUR TIMEMETER INCUDING 10'THS OF HOUR
28	PHOENIX CONTACT	3044814	M 4 FEED THROUGH MULTICONDUCTOR, MULTI-LEVEL TERMINAL
29	PHOENIX CONTACT	3044102	M 4/6 FEED THROUGH TERMINAL - GREY
30	PHOENIX CONTACT	3044128	M 4/6 GROUND TERMINAL - GREEN/YELLOW
31	PHOENIX CONTACT	3047028, 3047293	END SECTION - GREY
32	PHOENIX CONTACT	3030271	ASSEMBLED JUMPER BAR 10 POLES
33	PHOENIX CONTACT	0800886	END STOP - GREY
34	ALLEN BRADLEY	199-DR2	DIN Mounting rail - 2-meter
35	BURNDY	KA2U	Grounding Lug #14 to #2
36			1" x 2" WHITE LETTERS ON BLACK PHENOLIC NAMEPLATE (SEE SCHEDULE)

NO. | DATE | REVISION | BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

SHEET 3D-E7 165 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2026 MICHAEL E. WELLS
EXPIRES: 6/30/26

SCALE | VERT.: AS SHOWN | HORIZ.: AS SHOWN

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PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
ELECTRICAL
VFD PANEL LAYOUT

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 | DATE: MAY 2025

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AK #1018436
PROJECT#: 20.18.02

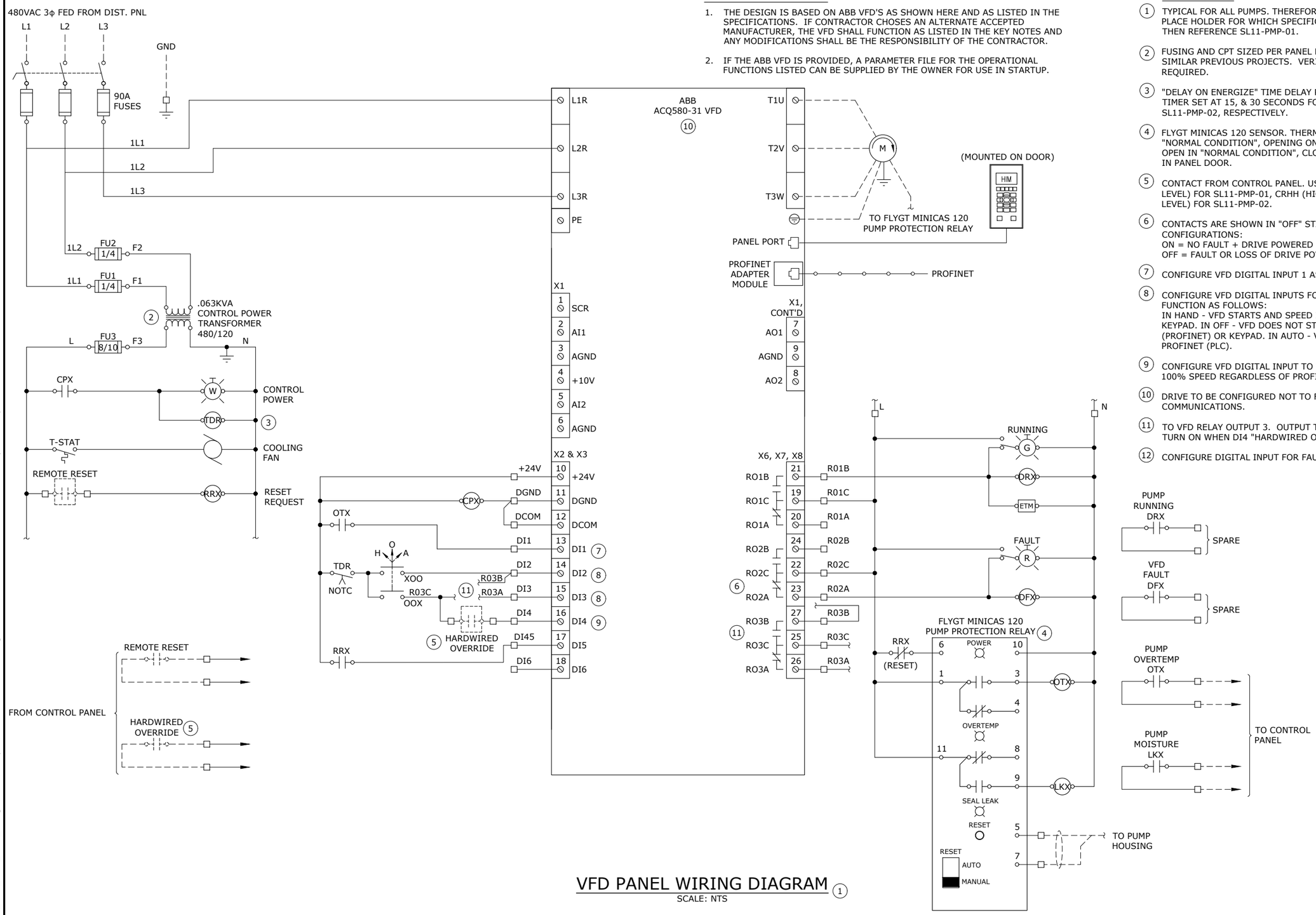
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GENERAL NOTES

1. THE DESIGN IS BASED ON ABB VFD'S AS SHOWN HERE AND AS LISTED IN THE SPECIFICATIONS. IF CONTRACTOR CHOSES AN ALTERNATE ACCEPTED MANUFACTURER, THE VFD SHALL FUNCTION AS LISTED IN THE KEY NOTES AND ANY MODIFICATIONS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
2. IF THE ABB VFD IS PROVIDED, A PARAMETER FILE FOR THE OPERATIONAL FUNCTIONS LISTED CAN BE SUPPLIED BY THE OWNER FOR USE IN STARTUP.

KEY NOTES

1. TYPICAL FOR ALL PUMPS. THEREFORE, "X" IN RELAY NAME IS PLACE HOLDER FOR WHICH SPECIFIC PUMP OF TWO. IF X = 1, THEN REFERENCE SL11-PMP-01.
2. FUSING AND CPT SIZED PER PANEL DESIGN PROVIDED ON SIMILAR PREVIOUS PROJECTS. VERIFY AND MODIFY IF REQUIRED.
3. "DELAY ON ENERGIZE" TIME DELAY RELAY, 0-60 SECOND TIMER SET AT 15, & 30 SECONDS FOR SL11-PMP-01, SL11-PMP-02, RESPECTIVELY.
4. FLYGT MINICAS 120 SENSOR. THERMAL CONTACT CLOSED IN "NORMAL CONDITION", OPENING ON FAULT. LEAK CONTACT OPEN IN "NORMAL CONDITION", CLOSING ON FAULT. MOUNT IN PANEL DOOR.
5. CONTACT FROM CONTROL PANEL. USE CRH (HIGH WET WELL LEVEL) FOR SL11-PMP-01, CRHH (HIGH HIGH WET WELL LEVEL) FOR SL11-PMP-02.
6. CONTACTS ARE SHOWN IN "OFF" STATE. FAULT OUTPUT CONFIGURATIONS:
   ON = NO FAULT + DRIVE POWERED
   OFF = FAULT OR LOSS OF DRIVE POWER
7. CONFIGURE VFD DIGITAL INPUT 1 AS AN ENABLE INPUT.
8. CONFIGURE VFD DIGITAL INPUTS FOR HAND AND AUTO TO FUNCTION AS FOLLOWS:
   IN HAND - VFD STARTS AND SPEED IS CONTROLLED VIA KEYPAD. IN OFF - VFD DOES NOT START FROM AUTO (PROFINET) OR KEYPAD. IN AUTO - VFD IS CONTROLLED BY PROFINET (PLC).
9. CONFIGURE VFD DIGITAL INPUT TO START VFD AND RUN AT 100% SPEED REGARDLESS OF PROFINET SETTINGS.
10. DRIVE TO BE CONFIGURED NOT TO FAULT ON LOSS OF COMMUNICATIONS.
11. TO VFD RELAY OUTPUT 3. OUTPUT TO BE PROGRAMMED TO TURN ON WHEN DI4 "HARDWIRED OVERRIDE" IS ON.
12. CONFIGURE DIGITAL INPUT FOR FAULT RESET.



VFD PANEL WIRING DIAGRAM (1)

SCALE: NTS

Industrial Systems INC
12119 NE 99th Street
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Vancouver, Washington 98682
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e-mail: is@industrialsystems-inc.com
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AK #1018436
PROJECT#: 20.18.02

NO.	DATE	REVISION	BY

SHEET 3D-E8 166 of 184

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

REGISTERED PROFESSIONAL ENGINEER OREGON MAY 14, 2004 MICHAEL E. WELLS 88305PE EXPIRES: 6/30/26

SCALE VERT.: AS SHOWN HORIZ: AS SHOWN

NOTICE IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
ELECTRICAL
VFD WIRING DIAGRAM

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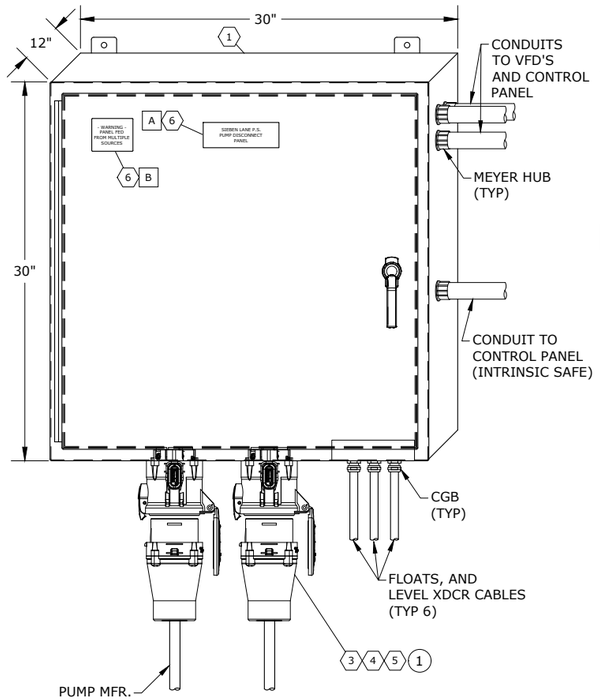
DATE: MAY 2025

19-2679

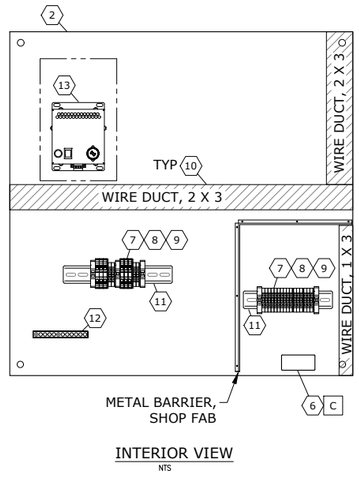
PROJECT:

CLACKAMAS WATER ENVIRONMENT SERVICES

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FRONT VIEW
NTS



INTERIOR VIEW
NTS

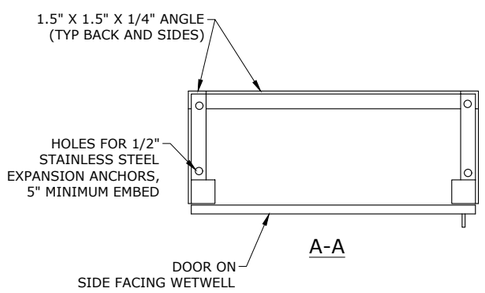
DETAIL NOTES

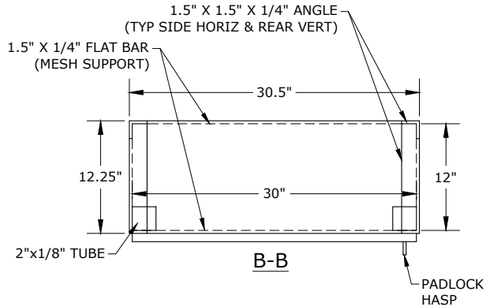
1. LABEL PUMP PLUGS AND PUMP RECEPTACLES WITH POLYPROPYLENE DYMO OR BRADY AGGRESSIVE ADHESIVE ¾" HIGH LABELS. LABEL AS "P1", AND "P2" WITH A MINIMUM SIZE 5 FONT.

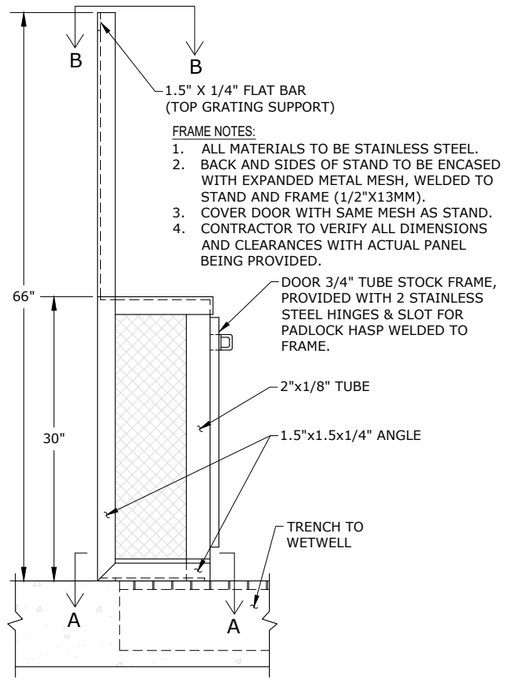
A	ITEM	NAMEPLATE SCHEDULE
	A	SIEBEN LANE P.S. PUMP DISCONNECT PANEL
	B	-WARNING- PANEL FED FROM MULTIPLE SOURCES
	C	INTRINSICALLY SAFE AREA

#	ITEM	QUANTITY	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	EQUALS ALLOWED
	1	1	NEMA 4 ENCLOSURE, 30"x30"x12"	SAGINAW	SCE-30EL3012SSLPPL	YES
	2	1	BACK PANEL	SAGINAW	SCE-30P30	YES
	3	2	PUMP RECEPTACLE (HP RATED SWITCH) W/AUX CONTACTS	MELTRIC	DSN SERIES	YES
	4	2	PUMP INLET (HP RATED) W/AUX CONTACTS	MELTRIC	DSN SERIES	YES
	5	2	INLET ACCESSORY HANDLE (SIZED FOR PUMP CABLE)	MELTRIC	DSN SERIES	YES
	6	3	PHENOLIC NAMEPLATE (SEE NAMEPLATE SCHEDULE)	PANEL FABRICATOR CHOICE		YES
	7	A/R	TERMINAL BLOCK (NON FUSED)	PANEL FABRICATOR CHOICE		YES
	8	A/R	TERMINAL BLOCK END STOP	PANEL FABRICATOR CHOICE		YES
	9	A/R	TERMINAL BLOCK END PLATE	PANEL FABRICATOR CHOICE		YES
	10	A/R	WIREWAY (SIZE AS NOTED ON DRAWING)	PANEL FABRICATOR CHOICE		YES
	11	A/R	DIN RAIL	PANEL FABRICATOR CHOICE		YES
	12	1	GROUND BUS	EATON C-H	GBK10	YES
	13	1	HEATER W/T-STAT, 125W	SAGINAW	SCE-HF1251A	YES

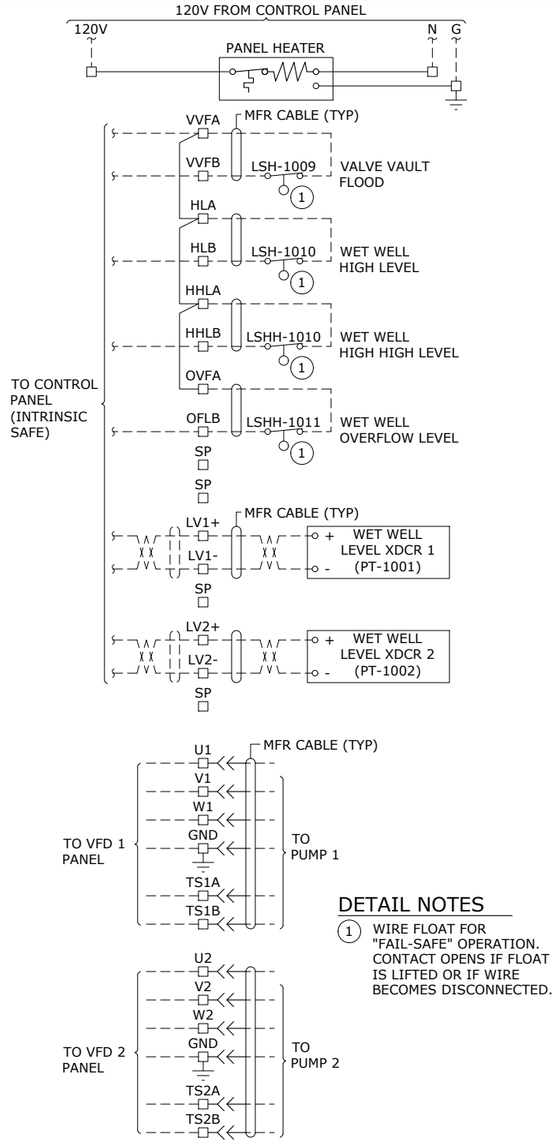
LAYOUT AND BILL OF MATERIALS
SCALE: NONE — 1 / -







PUMP DISCONNECT PANEL STAND
SCALE: NONE — 2 / -



DETAIL NOTES

1. WIRE FLOAT FOR "FAIL-SAFE" OPERATION. CONTACT OPENS IF FLOAT IS LIFTED OR IF WIRE BECOMES DISCONNECTED.

PUMP DISCONNECT PANEL WIRING
SCALE: NONE — 3 / -

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NO.	DATE	REVISION	BY

SHEET 3D-E9 167 of 184

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

REGISTERED PROFESSIONAL ENGINEER OREGON 88305PE MAY 14, 2010 MICHAEL E. WELLS
EXPIRES: 6/30/26

VERT: AS SHOWN
HORIZ: AS SHOWN
SCALE

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
PUMP DISCONNECT PANEL

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

Industrial Systems INC
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OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

KEY NOTES

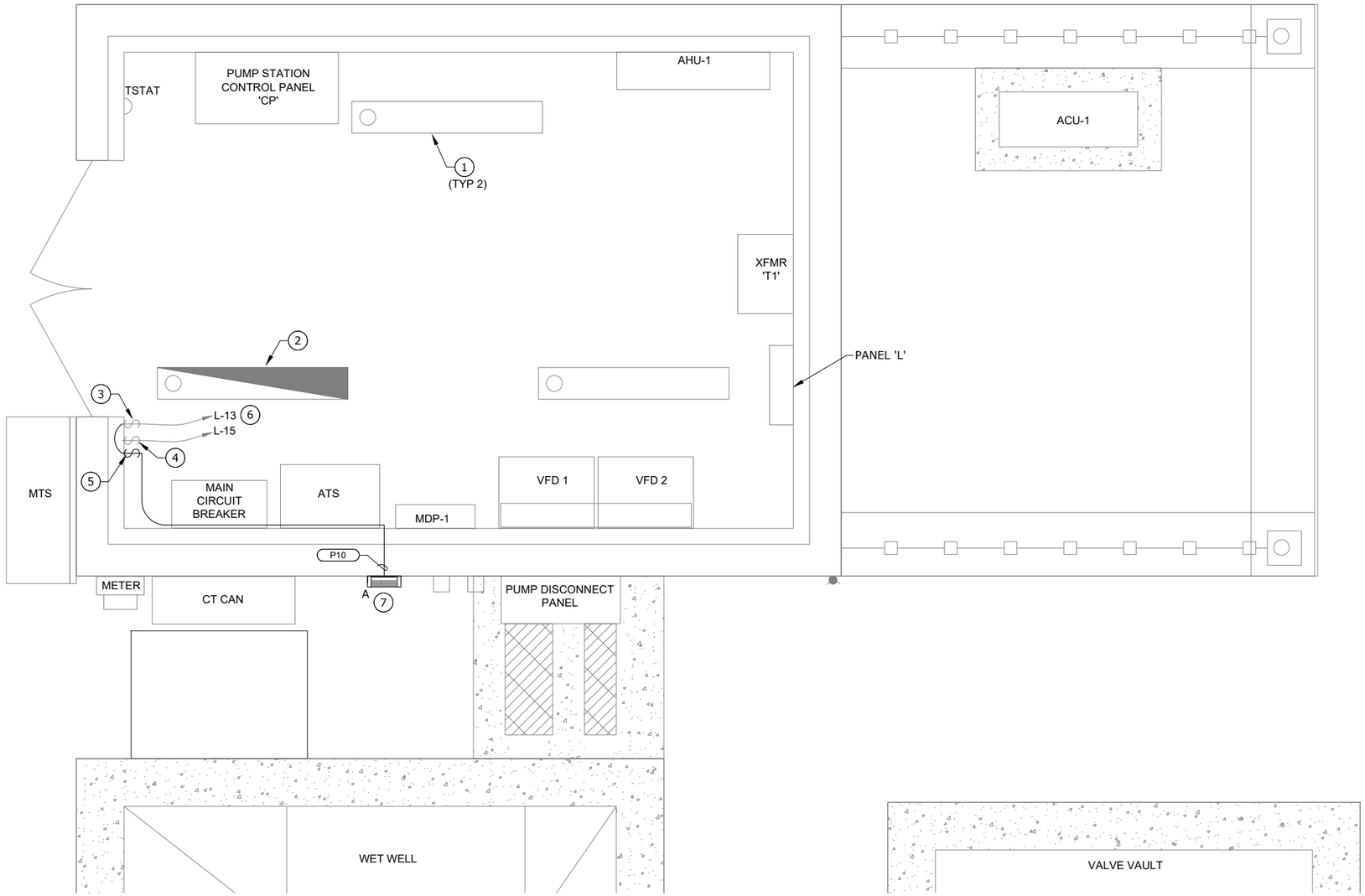
1. EXISTING LUMINAIRE TO REMAIN.
2. EXISTING BATTERY BACKED LUMINAIRE TO REMAIN.
3. EXISTING ON/OFF/AUTO SWITCH FOR EXTERIOR POLE MOUNTED LUMINAIRE TO REMAIN.
4. EXISTING SWITCH FOR INTERIOR LIGHTING TO REMAIN. SEE ALSO KEYED NOTE 5 BELOW.
5. ADD ADDITIONAL SWITCH AT EXISTING SWITCHES FOR NEW EXTERIOR BUILDING LUMINAIRE. AT CONTRACTORS DISCRETION, EITHER REPLACE EXSTING 2-GANG BOX WITH 3-GANG AND PROVIDE NEW SWITCH OR REPLACE EXISTING INTERIOR SWITCH WITH STACK SWITCH. LABEL NEW SWITCH "EXT. BLDG" AND EXISTING SWITCH "INT. BLDG". SWITCH SHALL BE MANUAL ON/OFF.
6. COMBINE NEW EXTERIOR BUILDING LIGHTING CIRCUIT TO EXISTING POLE EXTERIOR LIGHTING CIRCUIT 13.
7. CONTRACTOR TO COORDINATE AIMING OF LUMINAIRE WITH OWNER. MOUNT AT TOP OF BRICK AREA APPROXIMATELY 8' AFG.

LUMINAIRE SCHEDULE

TYPE	DESCRIPTION	MOUNTING	VOLTAGE	INPUT WATTS	MANUFACTURER PART NUMBER	BATTERY BACKED	COLOR TEMP	LAMP TYPE LUMENS	NOTES
A	HIGH PERFORMANCE LED, WET LOCATION FLOOD LIGHT WITH BRONZE DIE CAST ALUMINUM HOUSING AND INTERNAL HEAT SINK. SINGLE ENGINE PACKAGE WITH WIDE FLOOD RECTANGLE DISTRIBUTION AND PHOTOCELL.	WALL	120/277V	21	LITHONIA LIGHTING: DSXF1 LED SERIES OR AS APPROVED.	NO	40K	LED 3,058	PROVIDE WITH THK 1/2" NPT KNUCKLE
B	HIGH PERFORMANCE LED, WET LOCATION FLOOD LIGHT WITH BRONZE DIE CAST ALUMINUM HOUSING AND INTERNAL HEAT SINK. DUAL ENGINE PACKAGE WITH WIDE FLOOD RECTANGLE DISTRIBUTION AND PHOTOCELL.	POLE	120/277V	42	LITHONIA LIGHTING: DSXF1 LED SERIES OR AS APPROVED.	NO	40K	LED 5,573	PROVIDE WITH THK 1/2" NPT KNUCKLE

GENERAL NOTES

1. SEAL ALL CONDUIT PENETRATIONS, WATER-PROOF, FROM EXTERIOR TO INTERIOR OF BUILDING WITH NON-SHRINK GROUT.



ELECTRICAL EQUIPMENT PLAN

SCALE: 3/4"= 1'

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OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 20.18.02

NO. | DATE | REVISION | BY

DESIGNED: RSC
DRAWN: RSC
CHECKED: MEW
APPROVED: MEW

SHEET 3D-E10
168 of 184

REGISTERED PROFESSIONAL ENGINEER OREGON MAY 14, 2010 MICHAEL E. WELCHES 88305PE EXPIRES: 6/30/26

SCALE | VERT.: AS SHOWN | HORIZ.: AS SHOWN
NOTICE: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 — 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
ELECTRICAL
LIGHTING PLAN

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 | DATE: MAY 2025

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HMI

PLC

FIELD

TYPICAL 1 OF 2

ATS IN GEN. POSITION	ATS IN UTILITY POSITION	GEN. RUNNING	GEN. FAULT	SMOKE ELECT RM	DOOR INTRUSION	DOOR INTRUSION
YI 2010	YI 2010A	YI 2011	YA 2012	YS 1001	YS 1003	YS 1004

HOR IN REM	RUNNING	FAULT	RUN COMMAND	AMPS	SPEED	SPEED COMMAND	LEAK	OVER TEMP	FAULT RESET COMMAND
YI 1111A	YI 1111B	YA 1111C	YC 1111D	II 1111F	SI 1111G	SC 1111H	YA 1111J	YA 1111K	YC 1111E

WETWELL LEVEL A	WETWELL LEVEL B
LI 1002	LI 1002

WETWELL OVERFLOW	WETWELL LEVEL HIGH HIGH	WETWELL LEVEL HIGH
LSHH 1011	LSHH 1010	LSH 1010

DISCHARGE FLOW	VALVE VAULT SUMP HIGH
FI 1008	LSH 1009

1112

VFD 2

VFD 1

IB

PT 1001

PT 1002

LSHH 1011

LSHH 1010

LSH 1010

FIT 1008

LSH 1009

ATS

STATION ATS
SL21-ATS-01

GEN

STATION GENERATOR
SL21-GEN-01

YS 1001 SMOKE
SL21-SMK-01

YS 1003 INT. DOOR 1A

YS 1004 INT. DOOR 1B

FROM INFLUENT MANHOLE

12" SS

SL11-PMP-01

SL11-PMP-02

45HP

8" FM

SL11-LVT-01

SL11-LVT-02

PI 1111

PI 1112

10" FM

PI 1113

SL11-FIT-01

M

WET WELL

VALVE VAULT

6" FM

10" FM

6" FM TO DISCHARGE MANHOLE ON SE 142ND DR

10" FM TO DISCHARGE MANHOLE ON SE 142ND DR

PORTLAND Engineering Inc.

C:\AutoCAD Projects\V255 WES Pump Station Design\Sieben\SIEBEN_PID.dwg 3D-IC1 5/5/2025 1:05 PM PEI 24.0s (LMS Tech)

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC1 169 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SCHAUPP — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:

NOTICE
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0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
P&ID

consor

DATE: MAY 2025

19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT:

I/O	Description	Channel	Loop Sheet
AI	SPARE	SLOT 1, CH 0	3D-IC6
AI	WET WELL LEVEL 1	SLOT 1, CH 1	3D-IC6
AI	WET WELL LEVEL 2	SLOT 1, CH 2	3D-IC6
AI	DISCHARGE FLOW	SLOT 1, CH 3	3D-IC6
AI	SPARE	SLOT 1, CH 4	3D-IC6
AI	SPARE	SLOT 1, CH 5	3D-IC6
AI	SPARE	SLOT 1, CH 6	3D-IC6
AI	SPARE	SLOT 1, CH 7	3D-IC6
AO	SPARE	SLOT 2, CH 0	3D-IC7
AO	SPARE	SLOT 2, CH 1	3D-IC7
AO	SPARE	SLOT 2, CH 2	3D-IC7
AO	SPARE	SLOT 2, CH 3	3D-IC7
DI	POWER FAIL RELAY	SLOT 3, CH 0	3D-IC8
DI	POWER SUPPLY 1 STATUS	SLOT 3, CH 1	3D-IC8
DI	POWER SUPPLY 2 STATUS	SLOT 3, CH 2	3D-IC8
DI	PUMP 1 LEAK ALARM	SLOT 3, CH 3	3D-IC8
DI	PUMP 1 OVER TEMP	SLOT 3, CH 4	3D-IC8
DI	PUMP 2 LEAK ALARM	SLOT 3, CH 5	3D-IC8
DI	PUMP 2 OVER TEMP	SLOT 3, CH 6	3D-IC8
DI	SPARE	SLOT 3, CH 7	3D-IC8
DI	SPARE	SLOT 3, CH 8	3D-IC9
DI	INTRUSION BUILDING DOOR 1A	SLOT 3, CH 9	3D-IC9
DI	INTRUSION BUILDING DOOR 1B	SLOT 3, CH 10	3D-IC9
DI	SPARE	SLOT 3, CH 11	3D-IC9
DI	GENERATOR RUNNING	SLOT 3, CH 12	3D-IC9
DI	GENERATOR FAULT	SLOT 3, CH 13	3D-IC9
DI	ATS IN UTILITY POSITION	SLOT 3, CH 14	3D-IC9
DI	ATS IN GENERATOR POSITION	SLOT 3, CH 15	3D-IC9

I/O	Description	Channel	Loop Sheet
DI	SMOKE ALARM ELECT ROOM	SLOT 4, CH 0	3D-IC10
DI	SPARE	SLOT 4, CH 1	3D-IC10
DI	WET WELL HIGH FLOAT	SLOT 4, CH 2	3D-IC10
DI	WET WELL HIGH HIGH FLOAT	SLOT 4, CH 3	3D-IC10
DI	WET WELL OVER FLOW FLOAT	SLOT 4, CH 4	3D-IC10
DI	VALVE VAULT SUMP HIGH LEVEL	SLOT 4, CH 5	3D-IC10
DI	SPARE	SLOT 4, CH 6	3D-IC10
DI	SPARE	SLOT 4, CH 7	3D-IC10
DI	SPARE	SLOT 4, CH 8	3D-IC11
DI	SPARE	SLOT 4, CH 9	3D-IC11
DI	SPARE	SLOT 4, CH 10	3D-IC11
DI	SPARE	SLOT 4, CH 11	3D-IC11
DI	SPARE	SLOT 4, CH 12	3D-IC11
DI	SPARE	SLOT 4, CH 13	3D-IC11
DI	SPARE	SLOT 4, CH 14	3D-IC11
DI	SPARE	SLOT 4, CH 15	3D-IC11
DO	PUMP 1 RESET COMMAND	SLOT 5, CH 0	3D-IC12
DO	PUMP 2 RESET COMMAND	SLOT 5, CH 1	3D-IC12
DO	SPARE	SLOT 5, CH 2	3D-IC12
DO	SPARE	SLOT 5, CH 3	3D-IC12
DO	SPARE	SLOT 5, CH 4	3D-IC12
DO	SPARE	SLOT 5, CH 5	3D-IC12
DO	SPARE	SLOT 5, CH 6	3D-IC12
DO	SPARE	SLOT 5, CH 7	3D-IC12
DO	ALARM 1 TO TELEMETRY PLC	SLOT 5, CH 8	3D-IC13
DO	ALARM 2 TO TELEMETRY PLC	SLOT 5, CH 9	3D-IC13
DO	ALARM 3 TO TELEMETRY PLC	SLOT 5, CH 10	3D-IC13
DO	ALARM 4 TO TELEMETRY PLC	SLOT 5, CH 11	3D-IC13
DO	ALARM 5 TO TELEMETRY PLC	SLOT 5, CH 12	3D-IC13
DO	ALARM 6 TO TELEMETRY PLC	SLOT 5, CH 13	3D-IC13
DO	ALARM 7 TO TELEMETRY PLC	SLOT 5, CH 14	3D-IC13
DO	ALARM 8 TO TELEMETRY PLC	SLOT 5, CH 15	3D-IC13

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC2
170 of 184

REGISTERED PROFESSIONAL ENGINEER
OREGON
DEC. 17, 2024
CARL M. SISEMORE
EXPIRES: 06/30/2026

SCALE
VERT:
HORIZ:
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
IO LIST

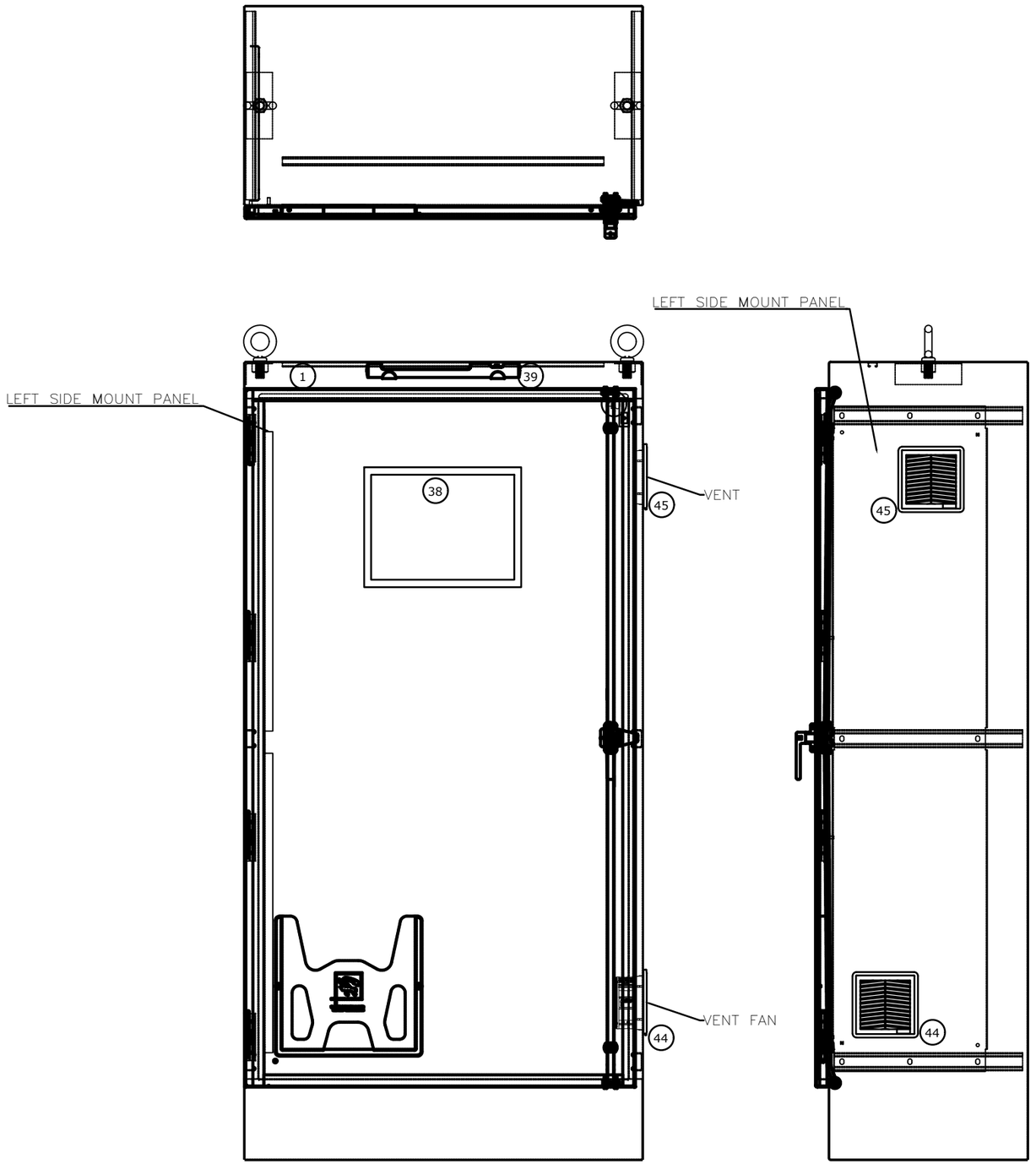
consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679
DATE: MAY 2025

PORTLAND Engineering Inc.

C:\AutoCAD Projects\V255 WES Pump Station Design\Sieben\SIEBEN-IND.dwg 3D-IC2 5/5/2025 10:26 AM PEI 24.0s (LMS Tech)



ITEM	QTY	BRAND	PART NUMBER	DESCRIPTION
1	1	HOFFMAN	A723618FS	NEMA 12 ENCLOSURE, 72" BY 36" BY 18"
2	1	HOFFMAN	A72P36F1	BACK PANEL, 60" BY 32"
3	1	HOFFMAN	A72SMP14	SIDE PANEL, 60" BY 14"
4	2	CUTLER HAMMER	GBK10	GROUND BAR
5	2	SOLA	SDN-10-24-100C	P/S 10A 24VDC 115/230
6	1	NTRON	108TX	8 PORT INDUSTRIAL ETHERNET SWITCH
7	10	ALLEN BRADLEY	1492-JG4	GROUND TERMINAL
8	1	ALTECH	1DU15L	MAIN CIRCUIT BREAKER, 15A
9	27	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK
10	37	ALLEN BRADLEY	1492-WFB424	FUSED TERMINAL, 24VDC, INDICATOR
11	6	ALLEN BRADLEY	1492-WFB4250	FUSED TERMINAL, 120VAC, INDICATOR
12	0	ALLEN BRADLEY	1492-WFB4	FUSED TERMINAL, NO INDICATOR
13	AR	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER
14	AR	ALLEN BRADLEY	1492-ERL35	J SCREWLESS END STOP
15	1	SIEMENS	6ES7511-1AK02-0AB0	S7-1500 CPU
16	1	SIEMENS	6ES7954-8LC02-0AA0	MEMORY CARD
17	1	SIEMENS	6ES7590-1AC40-0AA0	PLC MOUNTING RAIL
18	2	SIEMENS	6ES7521-1BH00-0AB0	DIGITAL INPUT MODULE, 16 PT, 24VDC
19	1	SIEMENS	6ES7531-7NF00-0AB0	ANALOG INPUT MODULE, 8 PT, ISOLATED, I/V
20	1	SIEMENS	6ES7522-1BH01-0AB0	DIGITAL OUTPUT MODULE, 16 PT, 24VDC
21	1	SIEMENS	6ES7532-5HD00-0AB0	ANALOG OUTPUT MODULE, 4 PT, I/V
22	3	SIEMENS	6ES7921-5AB20-0AA0	DIGITAL IO MODULE FRONT CONNECTOR
23	2	SIEMENS	6ES7921-5AK20-0AA0	ANALOG IO MODULE FRONT CONNECTOR
24	4	SIEMENS	6ES7924-0AA20-0AA0	DI TERMINATION MODULE
25	1	SIEMENS	6ES7924-0BD20-0BA0	DO 24VDC RELAY TERMINATION MODULE, LED
27	6	SIEMENS	6ES7924-0CC20-0AA0	AI TERMINATION MODULE
28	6	SIEMENS	6ES7923-0BB00-0DB0	CABLE, 16 PIN IDC, SHIELD, 1M FOR ANALOG
29	1	PHOENIX	5600462	DUPLEX OUTLET FOR UPS
30	6	SIEMENS	6ES7923-0BB50-0CB0	CABLE, 16 PIN IDC, 1.5M FOR DIGITAL MODULE
31	3	ALLEN-BRADLEY	700-HN-101	RELAY SOCKET
32	1	ALLEN-BRADLEY	700-HA33A1	RELAY, 120VAC COIL, 3 POLE
33	2	ALLEN-BRADLEY	700-HA33A24	RELAY, 24VDC COIL, 3 POLE
34	2	ALLEN-BRADLEY	700-FSM7UU23	TIMING RELAY
35	4	TURCK	IM1-121EX-R	INTRINSIC BARRIER, DISCRETE SIGNAL
36	2	TURCK	IM33-11EX-HI	INTRINSIC BARRIER, ANALOG SIGNAL
37				
38	1	EZ AUTOMATION	EZ3-T10C-E	10" TOUCH SCREEH HMI, 800X600 RES
39	1	STEGO	02541.0-00-003	PANEL LIGHT, 120VAC LED, MOTION, MAGNETIC
40	1	HOFFMAN	ALFSWD	DOOR SWITCH
41	1	SOLA	SDN2X20RED	24VDC REDUNDANCY MODULE
42	1	SOLA	SDU-10-24B	DC UPS POWER MODULE, 10A 24VDC
43	1	SOLA	SDU-24-BATEM	DC UPS BATTERY MODULE
44	1	SAGINAW	SCE-N12FA44	FILTER FAN, 120VAC
45	1	SAGINAW	SCE-N12FGA44	EXHAUST VENT
46	1	STEGO	01141.9-00	THERMOSTAT
47				
48	1	SHOP SUPPLY	UL LABEL	UL INDUSTRIAL LABEL
49	AR	SHOP SUPPLY	ENGRAVE PLAS NP	PLASTIC NAME PLATES
50	AR	SHOP SUPPLY		35 mm DIN RAIL
51	AR	SHOP SUPPLY		WIRE DUCT
52	AR	SHOP SUPPLY		WIRE DUCT COVER, WHITE

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC3 171 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JOSHUA C. MARR — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.: NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
PANEL EXTERIOR LAYOUT

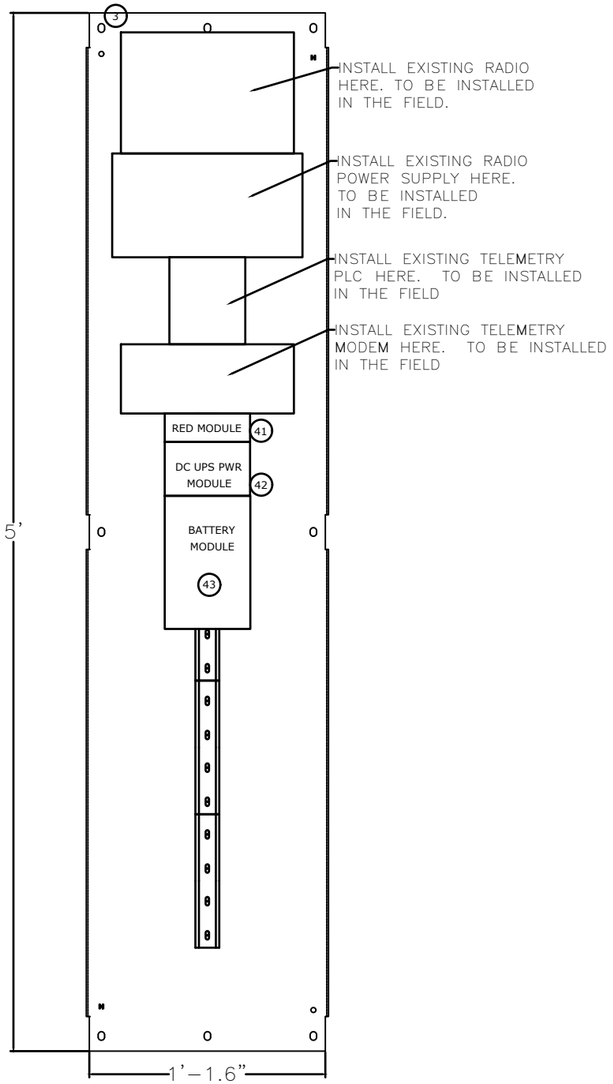
consor

CLACKAMAS WATER ENVIRONMENT SERVICES

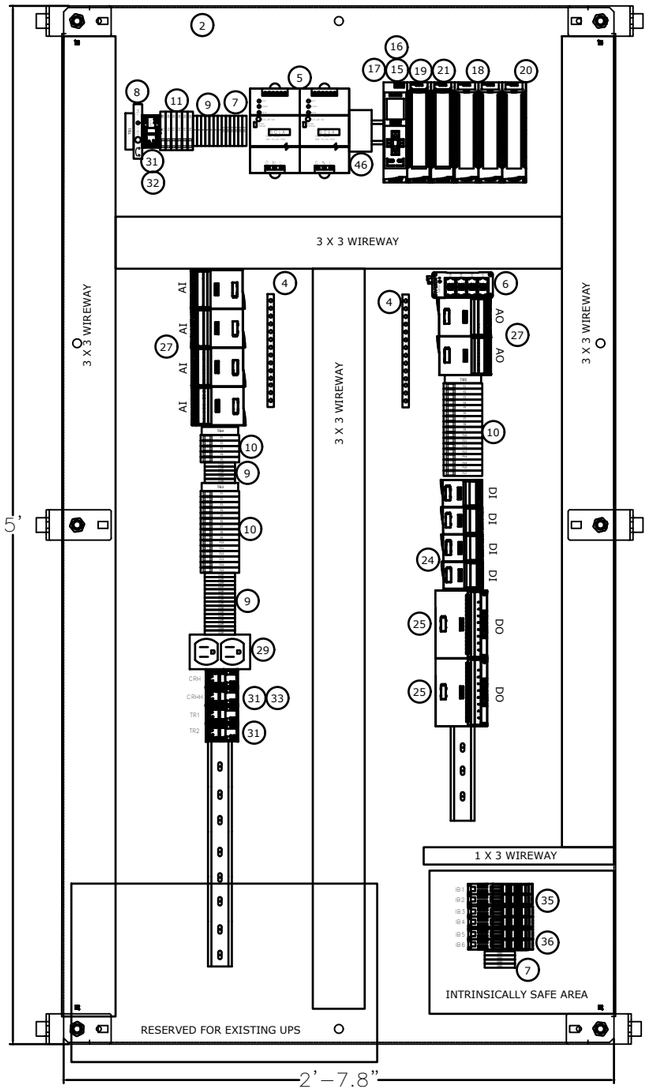
PROJECT: 19-2679 DATE: MAY 2025

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LEFT SIDE MOUNT PANEL



BACK PANEL



ITEM	QTY	BRAND	PART NUMBER	DESCRIPTION
1	1	HOFFMAN	A723618FS	NEMA 12 ENCLOSURE, 72" BY 36" BY 18"
2	1	HOFFMAN	A72P36F1	BACK PANEL, 60" BY 32"
3	1	HOFFMAN	A72SMP14	SIDE PANEL, 60" BY 14"
4	2	CUTLER HAMMER	GBK10	GROUND BAR
5	2	SOLA	SDN-10-24-100C	P/S 10A 24VDC 115/230
6	1	NTRON	108TX	8 PORT INDUSTRIAL ETHERNET SWITCH
7	10	ALLEN BRADLEY	1492-JG4	GROUND TERMINAL
8	1	ALTECH	1DU15L	MAIN CIRCUIT BREAKER, 15A
9	27	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK
10	37	ALLEN BRADLEY	1492-WFB424	FUSED TERMINAL, 24VDC, INDICATOR
11	6	ALLEN BRADLEY	1492-WFB4250	FUSED TERMINAL, 120VAC, INDICATOR
12	0	ALLEN BRADLEY	1492-WFB4	FUSED TERMINAL, NO INDICATOR
13	AR	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER
14	AR	ALLEN BRADLEY	1492-ERL35	J SCREWLESS END STOP
15	1	SIEMENS	6ES7511-1AK02-0AB0	S7-1500 CPU
16	1	SIEMENS	6ES7954-8LC02-0AA0	MEMORY CARD
17	1	SIEMENS	6ES7590-1AC40-0AA0	PLC MOUNTING RAIL
18	2	SIEMENS	6ES7521-1BH00-0AB0	DIGITAL INPUT MODULE, 16 PT, 24VDC
19	1	SIEMENS	6ES7531-7NF00-0AB0	ANALOG INPUT MODULE, 8 PT, ISOLATED, I/V
20	1	SIEMENS	6ES7522-1BH01-0AB0	DIGITAL OUTPUT MODULE, 16 PT, 24VDC
21	1	SIEMENS	6ES7532-5HD00-0AB0	ANALOG OUTPUT MODULE, 4 PT, I/V
22	3	SIEMENS	6ES7921-5AB20-0AA0	DIGITAL IO MODULE FRONT CONNECTOR
23	2	SIEMENS	6ES7921-5AK20-0AA0	ANALOG IO MODULE FRONT CONNECTOR
24	4	SIEMENS	6ES7924-0AA20-0AA0	DI TERMINATION MODULE
25	1	SIEMENS	6ES7924-0BD20-0BA0	DO 24VDC RELAY TERMINATION MODULE, LED
27	6	SIEMENS	6ES7924-0CC20-0AA0	AI TERMINATION MODULE
28	6	SIEMENS	6ES7923-0BB00-0DB0	CABLE, 16 PIN IDC, SHIELD, 1M FOR ANALOG
29	1	PHOENIX	5600462	DUPLEX OUTLET FOR UPS
30	6	SIEMENS	6ES7923-0BB50-0CB0	CABLE, 16 PIN IDC, 1.5M FOR DIGITAL MODULE
31	3	ALLEN-BRADLEY	700-HN-101	RELAY SOCKET
32	1	ALLEN-BRADLEY	700-HA33A1	RELAY, 120VAC COIL, 3 POLE
33	2	ALLEN-BRADLEY	700-HA33A24	RELAY, 24VDC COIL, 3 POLE
34	2	ALLEN-BRADLEY	700-FSM7UU23	TIMING RELAY
35	4	TURCK	IM1-121EX-R	INTRINSIC BARRIER, DISCRETE SIGNAL
36	2	TURCK	IM33-11EX-HI	INTRINSIC BARRIER, ANALOG SIGNAL
37				
38	1	EZ AUTOMATION	EZ3-T10C-E	10" TOUCH SCREEH HMI, 800X600 RES
39	1	STEGO	02541.0-00-003	PANEL LIGHT, 120VAC LED, MOTION, MAGNETIC
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41	1	SOLA	SDN2X20RED	24VDC REDUNDANCY MODULE
42	1	SOLA	SDU-10-24B	DC UPS POWER MODULE, 10A 24VDC
43	1	SOLA	SDU-24-BATEM	DC UPS BATTERY MODULE
44	1	SAGINAW	SCE-N12FA44	FILTER FAN, 120VAC
45	1	SAGINAW	SCE-N12FGA44	EXHAUST VENT
46	1	STEGO	01141.9-00	THERMOSTAT
47				
48	1	SHOP SUPPLY	UL LABEL	UL INDUSTRIAL LABEL
49	AR	SHOP SUPPLY	ENGRAVE PLAS NP	PLASTIC NAME PLATES
50	AR	SHOP SUPPLY		35 mm DIN RAIL
51	AR	SHOP SUPPLY		WIRE DUCT
52	AR	SHOP SUPPLY		WIRE DUCT COVER, WHITE

SHEET NOTES:

1. INSTALL BARRIER TO SEPARATE INTRINSICALLY SAFE AREA FROM OTHER PANEL COMPONENTS.

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC4
172 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SWANSON — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
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0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

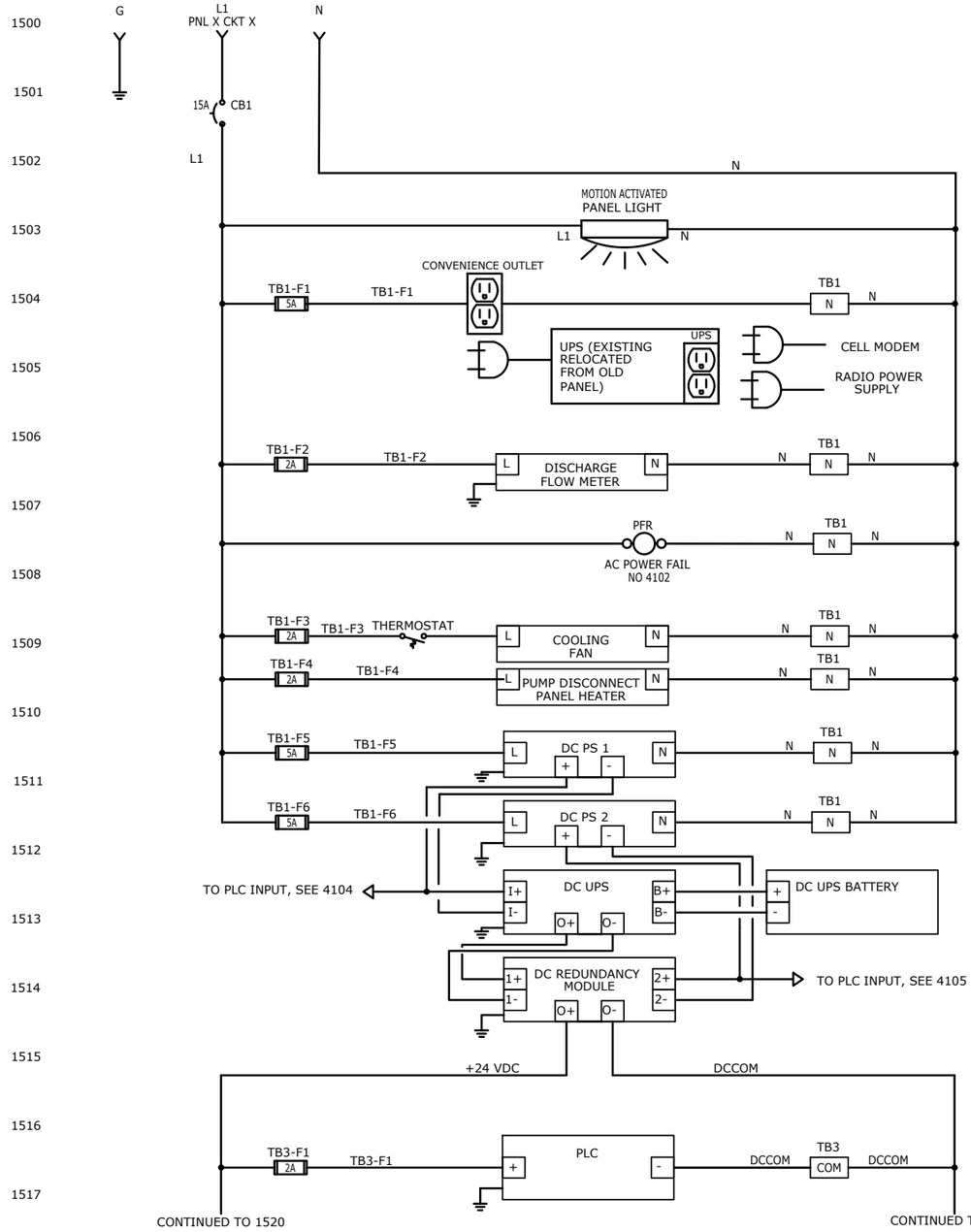
SIEBEN LN PUMP STATION
PANEL INTERIOR LAYOUT

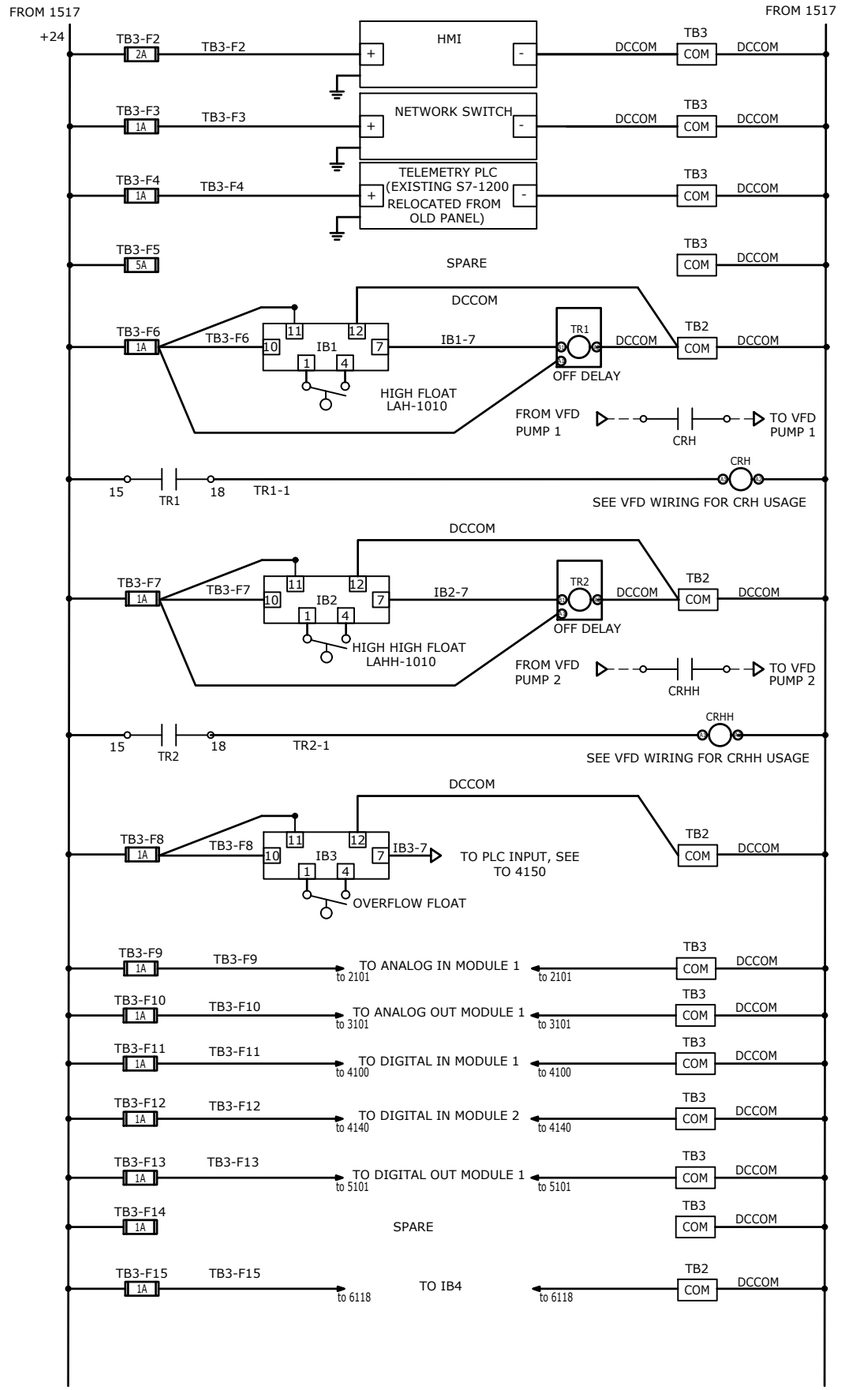
consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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WIRE COLORS UNLESS NOTED			
120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

SHEET 3D-IC5 173 of 184

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBER — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

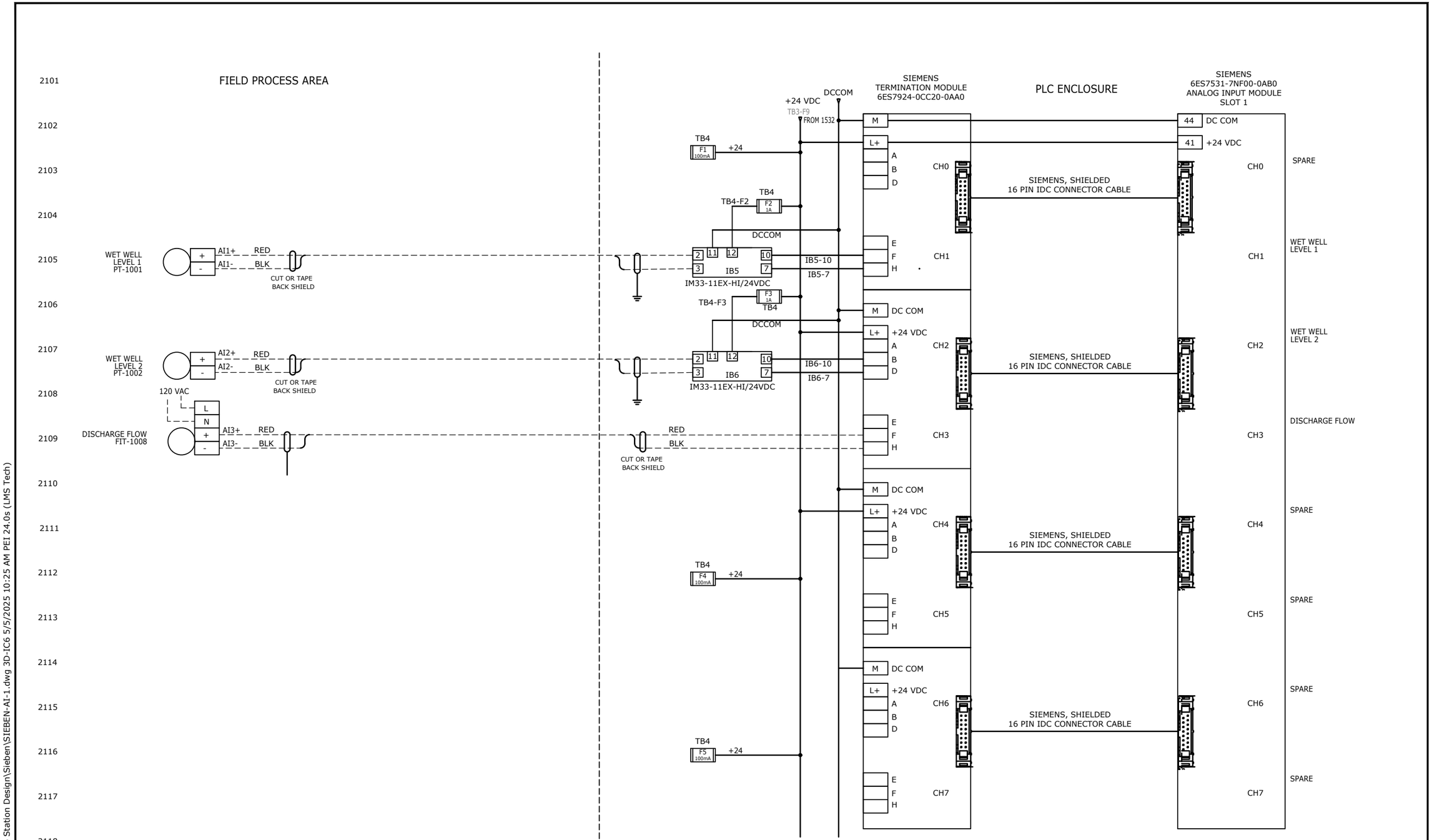
SIEBEN LN PUMP STATION
POWER DISTRIBUTION

consor

DATE: MAY 2025
PROJECT: 19-2679

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WIRE COLORS UNLESS NOTED			
120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

SHEET 3D-IC6 174 of 184

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBEN — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.: NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

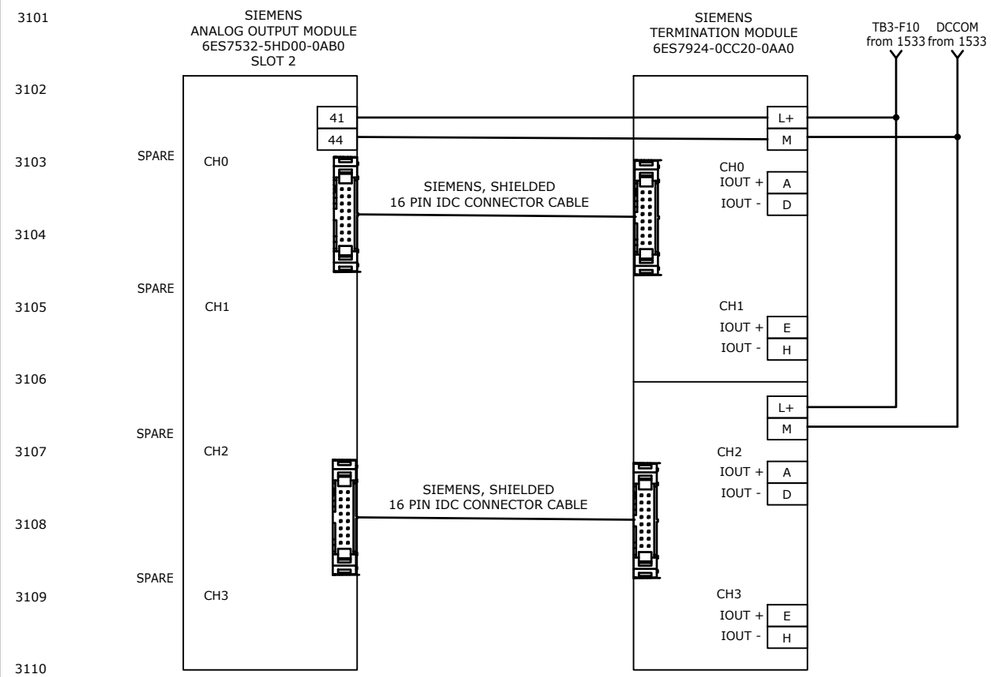
SIEBEN LN PUMP STATION
ANALOG INPUT

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CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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FIELD PROCESS AREA

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

PANEL WIRING
FIELD WIRING
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

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DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC7 175 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — EXPIRES: 06/30/2026

SCALE
VERT.:
HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
ANALOG OUTPUT

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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FIELD PROCESS AREA

4100
4101
4102
4103
4104
4105
4106
4107
4108
4109
4110
4111
4112
4113
4114
4115
4116
4117

POWER FAIL
PFR

PUMP 1 LEAK ALARM
YA-1111J

PUMP 1 OVERTEMP ALARM
YA-1111K

PUMP 2 LEAK ALARM
YA-1112J

PUMP 2 OVERTEMP ALARM
YA-1112K

PUMP 1 VFD

PUMP 2 VFD

+24 VDC
TB3-F11
FROM 1534

DCCOM

PFR
1508

DI1-0

FROM PS1, SEE 1513

FROM PS2, SEE 1514

TB5-F1
1A

DI1-3

TB5-F2
1A

DI1-4

TB5-F2
1A

DI1-5

DI1-6

TB5-F3
1A

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

M			
L+			
0	IN- 0	CH0	POWER FAIL STATUS
1	IN- 1	CH1	POWER SUPPLY 1 STATUS
2	IN- 2	CH2	POWER SUPPLY 2 STATUS
3	IN- 3	CH3	PUMP 1 LEAK
4	IN- 4	CH4	PUMP 1 OVER TEMP
5	IN- 5	CH5	PUMP 2 LEAK
6	IN- 6	CH6	PUMP 2 OVER TEMP
7	IN- 7	CH7	SPARE

SIEMENS
16 PIN IDC CONNECTOR CABLE

SIEMENS
6ES7522-1BH01-0AB0
DIGITAL INPUT MODULE
SLOT 3

20	DC COM		
19	+24 VDC		
CH0			POWER FAIL STATUS
CH1			POWER SUPPLY 1 STATUS
CH2			POWER SUPPLY 2 STATUS
CH3			PUMP 1 LEAK
CH4			PUMP 1 OVER TEMP
CH5			PUMP 2 LEAK
CH6			PUMP 2 OVER TEMP
CH7			SPARE

CONTINUED ON NEXT SHEET

CONTINUED ON NEXT SHEET

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

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NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC8 176 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — JAMES C. WHIPPLE — DEC. 17, 2024 — CARL M. SIEBERT — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE
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0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
DIGITAL INPUT - 1

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

FIELD PROCESS AREA

CONTINUED FROM PREV SHEET

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

+24 VDC

DC COM

M	DC COM		
L+	+24 VDC		
0	IN- 0	CH0	SPARE
1	IN- 1	CH1	INTRUSION MAIN DOOR 1A
2	IN- 2	CH2	INTRUSION MAIN DOOR 1B
3	IN- 3	CH3	SPARE
4	IN- 4	CH4	SPARE
5	IN- 5	CH5	VALVE VAULT FLOOD
6	IN- 6	CH6	ATS IN UTILITY POSITION
7	IN- 7	CH7	ATS IN GEN POSITION

4120
4121
4122
4123 — TB5-F4 — TB5-F4 1A — BUILDING DOOR 1A INTRUSION YS-1003 — DI1-9
4124
4125 — TB5-F5 — TB5-F5 1A — BUILDING DOOR 1B INTRUSION YS-1004 — DI1-10
4126
4127 — TB5-F6 — TB5-F6 1A
4128
4129 — TB5-F7 — TB5-F7 1A — GENERATOR RUNNING YI-2011 — DI1-12
4130
4131 — TB5-F8 — TB5-F8 1A — GENERATOR FAULT YA-2012 — DI1-13
4132
4133 — TB5-F9 — TB5-F9 1A — ATS IN UTILITY POSITION YI-2010 — DI1-14
4134
4135
4136 — ATS IN GENERATOR POSITION YI-2010A — DI1-15
4137

SIEMENS
16 PIN IDC CONNECTOR CABLE

CONTINUED ON PREVIOUS SHEET

DI1-1

CH8	SPARE
CH9	INTRUSION MAIN DOOR 1A
CH10	INTRUSION MAIN DOOR 1B
CH11	SPARE
CH12	SPARE

DI1-2

CH13	VALVE VAULT FLOOD
CH14	ATS IN UTILITY POSITION
CH15	ATS IN GEN POSITION

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC9 177 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIMPSON — DEC. 17, 2024 — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
DIGITAL INPUT - 2

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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FIELD PROCESS AREA

SIEMENS 6ES7924-0AA20-0AA0 TERMINATION MODULE

SIEMENS 6ES7522-1BH01-0AB0 DIGITAL INPUT MODULE SLOT 4

4140							
4141		TB5-F10	TB5-F10 1A	+24 VDC TB3-F12 FROM 1535	DCCOM	M	20 DC COM
						L+	19 +24 VDC
4142	SMOKE ELECT RM. YS-1001	DI2-0	TB3 COM	DCCOM		0 IN- 0 CH0	CH0 SMOKE ALARM ELECT ROOM
4143			TB5-F11 1A				
4144						1 IN- 1 CH1	CH1 SPARE
4145							
4146	WET WELL HIGH LEVEL FLOAT LSH-1010	CRH 1528	DI2-2			2 IN- 2 CH2	CH2 WET WELL HIGH FLOAT
4147							
4148	WET WELL HIGH HIGH LEVEL FLOAT LSHH-1010	CRHH 1530	DI2-3			3 IN- 3 CH3	CH3 WET WELL HIGH HIGH FLOAT
4149							
4150	WET WELL OVERFLOW FLOAT LSHH-1011	FROM IB3, SEE 6115	DI2-4			4 IN- 4 CH4	CH4 WET WELL OVER FLOW FLOAT
4151							
4152	VALVE VAULT HIGH WATER LSH-1009	FROM IB4, SEE 6118	DI2-5			5 IN- 5 CH5	CH5 VALVE VAULT HIGH WATER
4153			TB5-F12 1A				
4154						6 IN- 6 CH6	CH6 SPARE
4155			TB5-F13 1A				
4156						7 IN- 7 CH7	CH7 SPARE
4157							

SIEMENS 16 PIN IDC CONNECTOR CABLE

CONTINUED ON NEXT SHEET

CONTINUED ON NEXT SHEET

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC10 178 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIEBER — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.: NOTICE

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
DIGITAL INPUT - 3

consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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FIELD PROCESS AREA

CONTINUED FROM PREV SHEET

+24 VDC

DC COM

SIEMENS
6ES7924-0AA20-0AA0
TERMINATION MODULE

TB5-F14 1A

TB5-F15 1A

TB5-F16 1A

TB5-F17 1A

M	DC COM	
L+	+24 VDC	
0	IN- 0	CH0
1	IN- 1	CH1
2	IN- 2	CH2
3	IN- 3	CH3
4	IN- 4	CH4
5	IN- 5	CH5
6	IN- 6	CH6
7	IN- 7	CH7

SIEMENS 16 PIN IDC CONNECTOR CABLE

CONTINUED ON PREVIOUS SHEET

CH8	SPARE
CH9	SPARE
CH10	SPARE
CH11	SPARE
CH12	SPARE
CH13	SPARE
CH14	SPARE
CH15	SPARE

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC11 179 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — DEC. 17, 2024 — CARL M. SIMPSON

EXPIRES: 06/30/2026

SCALE VERT: HORIZ:

NOTICE: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LANE PUMP STATION
DIGITAL INPUT - 4

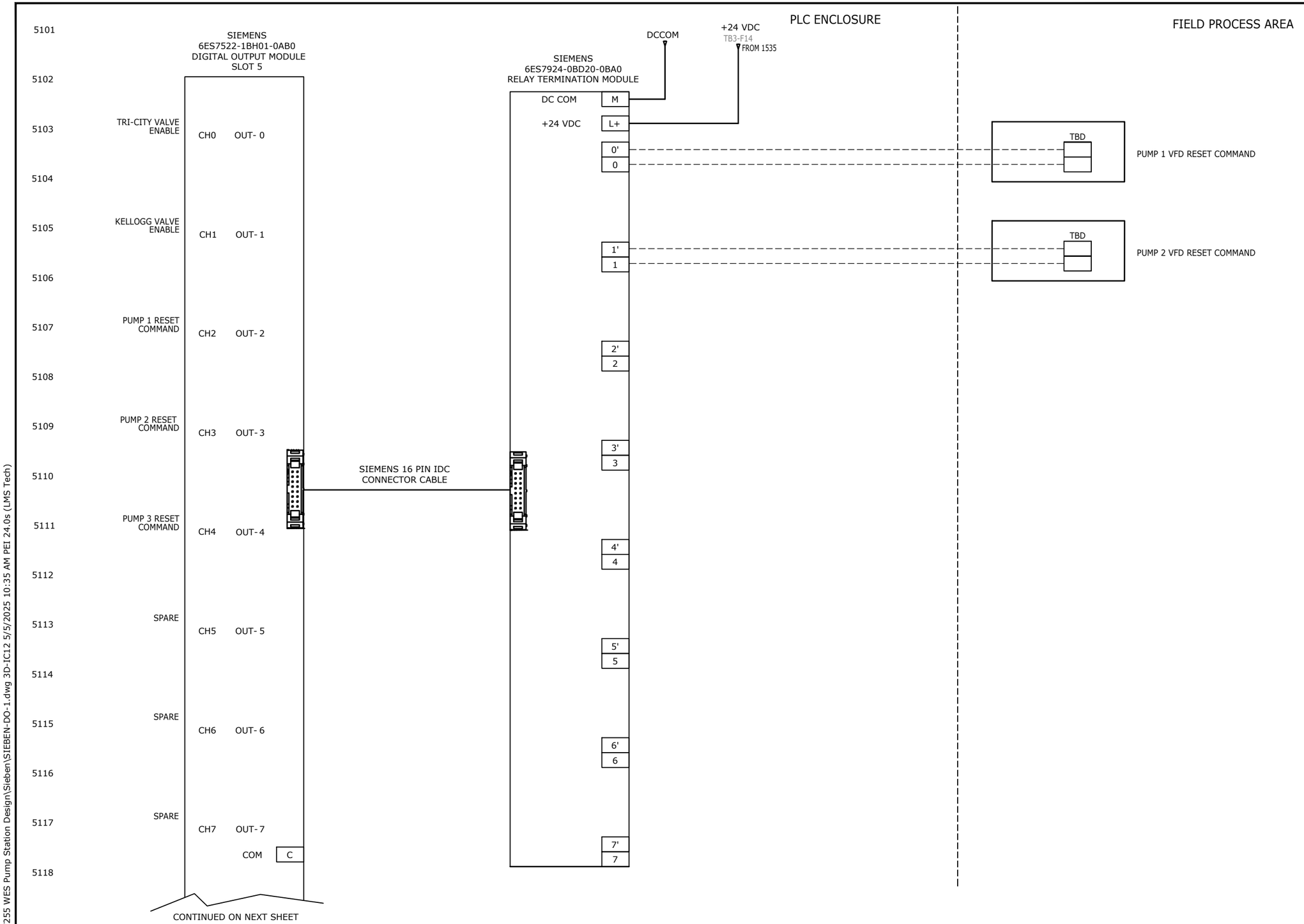
consor

DATE: MAY 2025

PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

C:\AutoCAD Projects\V255 WES Pump Station Design\Sieben\SIEBEN-DI-4.dwg 3D-IC11 5/5/2025 10:36 AM PEI 24.0s (LMS Tech)



WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC12 180 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SIMPSON — DEC. 17, 2024

EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
DIGITAL OUTPUT - 1

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CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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PLC ENCLOSURE

CONTINUED FROM PREVIOUS SHEET

DCCOM +24 VDC

SIEMENS
6ES7522-1BH01-0AB0
DIGITAL OUTPUT MODULE
SLOT 5

CONTINUED ON PREVIOUS SHEET

5121		
5122		
5123	ALARM 1 TO TELEMETRY PLC	CH8
5124		
5125	ALARM 2 TO TELEMETRY PLC	CH9
5126		
5127	ALARM 3 TO TELEMETRY PLC	CH10
5128		
5129	ALARM 4 TO TELEMETRY PLC	CH11
5130		
5131	ALARM 5 TO TELEMETRY PLC	CH12
5132		
5133	ALARM 6 TO TELEMETRY PLC	CH13
5134		
5135	ALARM 7 TO TELEMETRY PLC	CH14
5136		
5137	ALARM 8 TO TELEMETRY PLC	CH15
	COM	C
5138		

SIEMENS 16 PIN IDC CONNECTOR CABLE

SIEMENS
6ES7924-0BD20-0BA0
RELAY TERMINATION MODULE

DC COM M
+24 VDC L+
JUMPER

0'	0	+24VDC / INPUT	WET WELL HIGH FLOAT TO TELEMETRY PLC
1'	1	INPUT	WET WELL HIGH HIGH FLOAT TO TELEMETRY PLC
2'	2	INPUT	WET WELL OVERFLOW FLOAT TO TELEMETRY PLC
3'	3	INPUT	CONTROL POWER FAIL TO TELEMETRY PLC
4'	4	INPUT	PUMPS GENERAL ALARM TO TELEMETRY PLC
5'	5	INPUT	ATS IN GENERATOR POSITION TO TELEMETRY PLC
6'	6	INPUT	GENERATOR FAULT TO TELEMETRY PLC
7'	7	INPUT	SMOKE ALARM TO TELEMETRY PLC

EXISTING TELEMETRY PLC

SHEET NOTES:

1. EXISTING TELEMETRY PLC TERMINATION POINTS PROGRAMMER SHALL MAP ALARM BITS IN MAIN PLC TO OUTPUT FOR TELEMETRY PLC. PROGRAMMER SHALL COORDINATE TELEMETRY ALARMS AT TRI-CITY HMI TO MATCH ALARMS SHOWN HERE.

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

PANEL WIRING
FIELD WIRING
NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC13 181 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — DEC. 17, 2024 — CARL M. SWAPE — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:
NOTICE: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0 — 1)

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
DIGITAL OUTPUT - 2

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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SHEET NOTES:

1. INTRINSICALLY SAFE DETAIL APPLIES TO ANALOG INPUT ON SHEET 1A-IC6. APPLIES TO FLOAT CONTROLS ON SHEET 1A-IC5. CERTIFICATION: TURCK IECEx TUN 06.0007X

HAZARDOUS AREA
CLASS 1, DIVISION 1, GROUP D

SAFE AREA

WETWELL LEVEL 1
PT-1001

BLU
WHT

TB4-F2 DCCOM

IB5
IM33-11EX-HI/24VDC

PLC ANALOG INPUT MODULE 1
IB5-7 F
IB5-10 H

WETWELL LEVEL 2
PT-1002

BLU
WHT

TB4-F3 DCCOM

IB6
IM33-11EX-HI/24VDC

PLC ANALOG INPUT MODULE 1
IB6-7 B
IB6-10 D

HIGH FLOAT

LSH-1010

IB1
IM1-121EX-R/24VDC

TR1 DCCOM
TB2 COM DCCOM
TB3-F6 1A +24VDC

HIGH HIGH FLOAT

LSHH-1010A

IB2
IM1-121EX-R/24VDC

TR2 DCCOM
TB2 COM DCCOM
TB3-F7 1A +24VDC

WET WELL OVERFLOW

LSHH-1011

IB3
IM1-121EX-R/24VDC

TO PLC INPUT, SEE 4150
TB2 COM DCCOM
TB3-F8 1A +24VDC

VAULT HIGH WATER

LSHH-1011

IB4
IM1-121EX-R/24VDC

TO PLC INPUT, SEE 4152
TB2 COM DCCOM
TB3-F15 1A +24VDC

WIRE COLORS UNLESS NOTED

120 VAC +	RED	TSP +	RED
120 VAC N	WHT	TSP -	BLK
24 VDC +	BLU	GROUND	GRN
24 VDC COM	WHT/BLU		

NEW FIELD WIRING THHN 14 GA
PANEL WIRING MTW 16 GA

PANEL WIRING
FIELD WIRING
WIRE TERMINAL
FUSED TERMINAL
GND TERMINAL

PORTLAND Engineering Inc.

NO. | DATE | REVISION | BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC14
182 of 184

REGISTERED PROFESSIONAL ENGINEER
SIGNATURE
OREGON
DEC. 17, 2024
CARL M. SIMS
EXPIRES: 06/30/2026

SCALE
VERT.:
HORIZ.:
NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

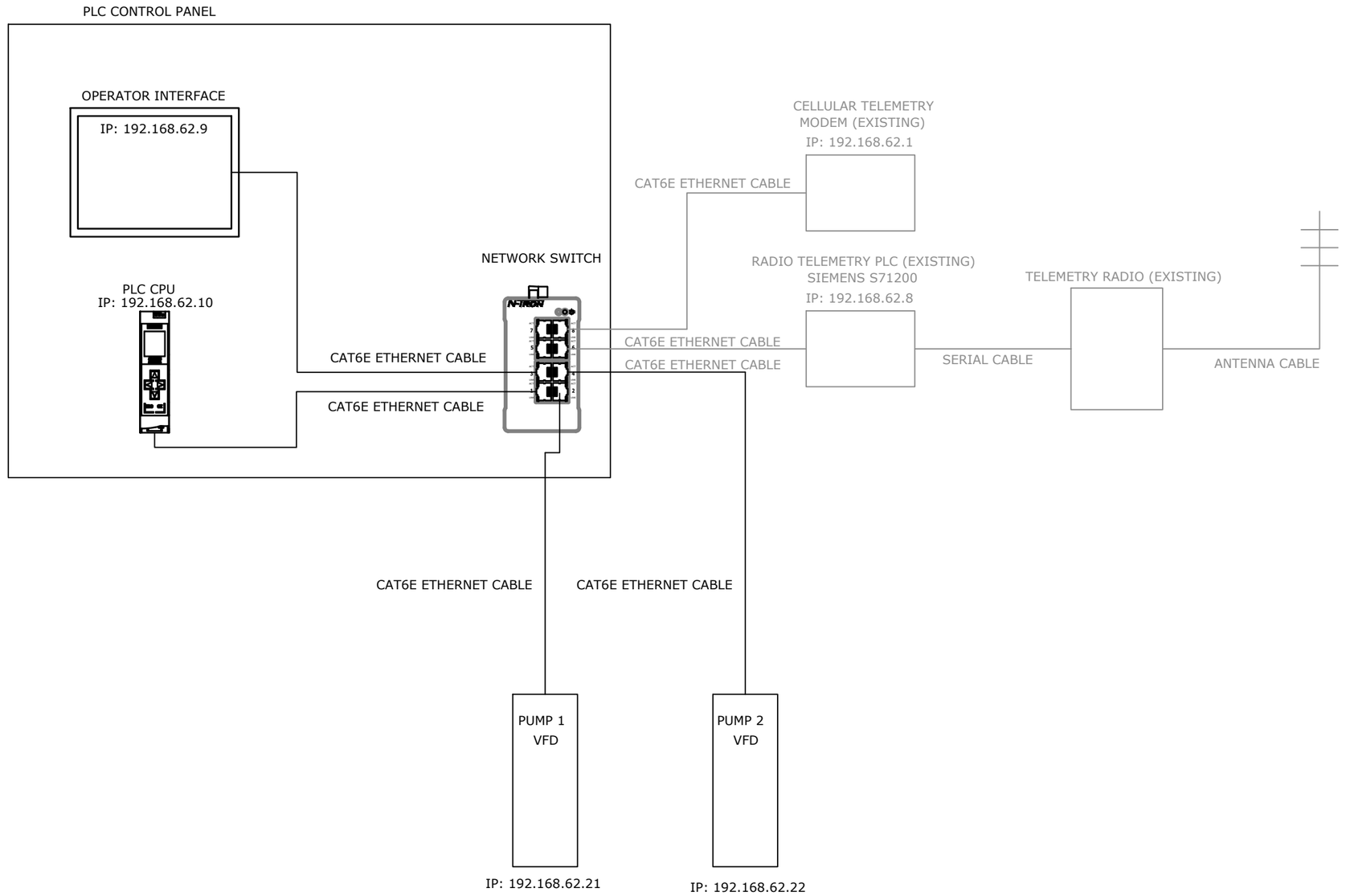
SIEBEN LN PUMP STATION
INTRINSIC SAFETY

consor

DATE: MAY 2025
PROJECT: 19-2679

CLACKAMAS WATER ENVIRONMENT SERVICES

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NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC15 183 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. SWAPE — EXPIRES: 06/30/2026

SCALE VERT.: HORIZ.:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
NETWORK DETAIL

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

PORTLAND Engineering Inc.

SHEET NOTES:

1. PULL BACK AND RE-ROUTE EXISTING ANTENNA WIRES FOR CELLULAR MODEM AND RADIO INTO NEW CONTROL PANEL.



REMOVE EXISTING CONTROL PANEL/BUBBLER PANEL. INSTALL NEW CONTROL PANEL IN SAME LOCATION.

EXISTING CONTROL PANEL AND BUBBLER DEMOLITION 1/-



EXISTING TELEMETRY PANEL: REMOVE S7-1200 PLC, SERIAL MODEM AND CABLES IN THIS PANEL AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 2B-IC4 FOR INSTALL LOCATION. SALVAGE ENCLOSURE AND REMAINING PARTS AND RETURN TO WATER ENVIRONMENT SERVICES.

REMOVE EXISTING RADIO AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 2B-IC4 FOR INSTALL LOCATION.

MOVE EXISTING UPS UNITS TO BOTTOM OF NEW CONTROL PANEL.

REMOVE EXISTING CELLULAR MODEM AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 2A-IC4 FOR INSTALL LOCATION.

SALVAGE EXISTING BUBBLER SYSTEM COMPRESSORS DELIVER TO WATER ENVIRONMENT SERVICES.

EXISTING CONTROL PANEL DEMOLITION DETAIL 2/-



EXISTING RADIO POWER PANEL: REMOVE RADIO POWER SUPPLY IN THIS PANEL AND RE-INSTALL IN NEW CONTROL PANEL. SEE SHEET 2A-IC4 FOR INSTALL LOCATION.

EXISTING CONTROL PANEL DEMOLITION DETAIL 3/-

PORTLAND Engineering Inc.

NO.	DATE	REVISION	BY

DESIGNED: JCH
DRAWN: JCH
CHECKED: CMS
APPROVED:

SHEET 3D-IC16
184 of 184

REGISTERED PROFESSIONAL ENGINEER — OREGON — CARL M. WOOSLEY — EXPIRES: 06/30/2026

SCALE VERT: HORIZ:

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
0 1

PUMP STATION REHABILITATION AND UPGRADES
GROUP 3 - SOUTH WELCHES, GCT, 82ND DR & SIEBEN LN PS

SIEBEN LN PUMP STATION
INSTALL AND DEMOLITION DETAIL

consor

CLACKAMAS WATER ENVIRONMENT SERVICES

PROJECT: 19-2679 DATE: MAY 2025

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ADDENDUM NO. 1

TO THE

CONTRACT DOCUMENTS

FOR

PUMP STATION REHABILITATION AND UPGRADES PROJECT –
GROUP 3

FOR

CLACKAMAS COUNTY WATER ENVIRONMENT SERVICES

OREGON CITY, OREGON

THIS ADDENDUM IS HEREBY MADE A PART OF THE CONTRACT DOCUMENTS TO THE SAME EXTENT AS THOUGH IT WERE ORIGINALLY INCLUDED THEREIN.

BIDDERS MUST ACKNOWLEDGE RECEIPT OF ALL ADDENDA ON THE BID PROPOSAL FORM. BID PROPOSALS THAT FAIL TO ACKNOWLEDGE ALL ADDENDA MAY BE CONSIDERED IRREGULAR AND MAY BE REJECTED.

ISSUED THIS 12 August 2025.

CONSOR NORTH AMERICA
One SW Columbia Street Suite 1700
Portland, Oregon 97204
(503) 225-9010

VOLUME 1 of 3

ITEM NO. 1 – SECTION 01 45 00 – QUALITY CONTROL

REPLACE Subsection 3.1-A Field Testing Schedule with the following:

Material to be Tested	Payment Responsibility for Initial Testing	Minimum Testing Frequency
Structural Backfill	CONTRACTOR	See Article 3.5, Field Quality Control of Section 31 23 23, Fill for further details on testing requirements.
Trench Backfill	CONTRACTOR	See Article 3.16, Field Quality Control of Section 31 23 17, Trenching for further details. A minimum of 2 tests will be required.
Asphalt Concrete	CONTRACTOR	As required when placed. See detailed requirements Section 32 12 16, Asphalt Paving. A total of 2 tests will be provided.
Concrete	CONTRACTOR	As required when placed. See detailed requirements in Article 3.15, Quality Control Testing During Construction of Section 03 30 00, Cast-In-Place Concrete Work.
Grout	CONTRACTOR	Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the ENGINEER to ensure continued compliance with SPECIFICATIONS. See detailed requirements in Article 1.6, Quality Assurance of Section 03 60 00, Grouting.
Masonry	CONTRACTOR	As required by Chapter 17 of the Oregon Structural Specialty Code per TMS 402 Table 3.1 – Level 3 Quality Assurance and TMS 602, Table 4 – Level 3 Quality Assurance, see detailed requirements in Section 04 22 00, Concrete Masonry Units
Post Installed Anchors	CONTRACTOR	Periodic intermittent inspection by an approved special inspector who is present in the area where the WORK has been or is being completed and at the completion of the WORK.
Seismic Supports	CONTRACTOR	Per IBC codes 1705.13.5, 1705.13.7 and Table 1705.13.7

ITEM NO. 2 – SECTION 03 30 00 – CAST-IN-PLACE CONCRETE WORK

REPLACE Subsection 1.5-B Concrete Testing Service with the following:

The CONTRACTOR will engage a special inspector/testing laboratory to perform material evaluation tests and to design concrete mixes. See detailed requirements in Part 3.14 "Quality Control Testing during Construction". Per the OWNER or ENGINEER's requirements the CONTRACTOR shall schedule the special inspections and materials testing required by the project documents.

REPLACE Subsection 1.5-C Testing Requirements with the following:

Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at anytime during the progress of the work. Allow free access to material stockpiles and facilities at all

times. The costs for preparation of mix designs (if required by the OWNER to be performed by an independent testing laboratory) and testing of concrete and materials shall be borne by the CONTRACTOR.

REPLACE Subsection 3.14-A with the following:

The CONTRACTOR will engage a special inspector/testing laboratory to perform all tests and to submit test reports to the OWNER, ENGINEER, and the CONTRACTOR.

ITEM NO. 3 – SECTION 04 05 17 – MASONRY MORTAR AND GROUT

REPLACE Subsection 1.4-A with the following:

Testing Service -- The CONTRACTOR will engage an independent testing laboratory to perform material evaluation tests and to perform required Special Inspections.

REPLACE Subsection 1.4-B with the following:

Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at any time during the progress of the Work. Allow free access to material stockpiles and facilities at all times. All initial testing required by the Contract Documents shall be done at the CONTRACTOR's expense. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

ITEM NO. 4 – SECTION 04 22 00 – MASONRY MORTAR AND GROUT

REPLACE Subsection 1.4-C Testing Service with the following:

Testing Service -- The CONTRACTOR will engage an independent testing laboratory to perform material evaluation tests and to perform required Special Inspections.

REPLACE Subsection 1.4-D with the following:

Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. All testing required by the contract documents shall be done at the CONTRACTOR's expense. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

ITEM NO. 5 – SECTION 05 40 00 – COLD FORMED STEEL

REPLACE Subsection 3.5-A with the following:

Testing: CONTRACTOR will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

ITEM NO. 6 – SECTION 05 50 00 – METAL FABRICATIONS

REPLACE Subsection 2.5-D.1 Cast In Place Concrete Work with the following:

Cast in place concrete shall meet the requirements of Specification 03 30 00 Cast-In-Place Concrete Work and shall meet the dimensional requirements as shown on the drawings.

ITEM NO. 7 – SECTION 06 10 00 – ROUGH CARPENTRY

REPLACE Subsection 1.4-B with the following:

Where special inspection of wood structural elements is required in the Contract Documents, an independent testing agency or laboratory shall perform special inspection of the elements indicated in the Contract Documents. The CONTRACTOR will engage a testing laboratory acceptable to the ENGINEER to perform the required Special Inspections and/or Material Tests.

REPLACE Subsection 1.4-C.2 with the following:

All testing required by the contract documents shall be done at the CONTRACTOR'S expense.

ITEM NO. 8 – SECTION 09 90 00 – PAINTING AND COATING

REPLACE Subsection 2.3-B.11.g with the following:

Coating shall be Raven 405, Tnemec Epoxytec Sprayliner, or approved equal. The coating shall be applied with minimum thickness of 120 mils.

ITEM NO. 9 – SECTION 22 14 29 – SUBMERSIBLE SUMP PUMPS

REMOVE specification Section 22 14 19 – Submersible Sump Pumps

VOLUME 2 of 3

ITEM NO. 10 – SECTION 26 32 13 – DIESEL-ENGINE GENERATORS

REPLACE Subsection 1.4-H.1 with the following:

Tier 3 standby emission limits

ITEM NO. 11 – SECTION 31 23 17 – TRENCHING

REPLACE Subsection 1.1-C.2 with the following:

Section 03 30 00 – Cast-In-Place Concrete Work

REPLACE Subsection 1.4-F with the following:

Concrete: Mix designs in accordance with Submittal requirements of Section 03 30 00, Cast-In-Place Concrete Work.

REPLACE Subsection 2.1-C.2 with the following:

> Structural concrete as specified in Section 03 30 00, Cast-In-Place Concrete Work with compressive strength of 3,000 psi.

ITEM NO. 12 – SECTION 33 31 10 – SANITARY UTILITY SEWERAGE PIPING

REPLACE Subsection 1.2-A with the following:

> Section 03 30 00 – Cast-In-Place Concrete Work

ITEM NO. 13 – SECTION 43 21 39 – SUBMERSIBLE LIQUID PUMPS

REMOVE Subsection 2.1-A.1.b

REMOVE Subsection 2.1-B.1.b

REMOVE Subsection 2.1-C.1.b

REMOVE Subsection 2.1-D.1.b

VOLUME 3 of 3

ITEM NO. 14 – SCHEDULE A – SHEETS

*Sheets replaced for visual clarity only, content remains unchanged

REPLACE Sheet 3A-G2 – Design Data Table and System Curve with the attached version.

REPLACE Sheet 3A-C4 – Site Plan with the attached version.

REPLACE Sheet 3A-C5 – Surfacing and Grading Plan with the attached version.

REPLACE Sheet 3A-E6 – Soft Starter Panel Layout with the attached version.

REPLACE Sheet 3A-E8 – Pump Disconnect Panel with the attached version.

ITEM NO. 15 – SCHEDULE B - SHEETS

*Sheets replaced for visual clarity only, content remains unchanged

REPLACE Sheet 3B-G2 – Design Data Table and System Curve with the attached version.

REPLACE Sheet 3B-C6 – Water Service Connection Plan with the attached version.

REPLACE Sheet 3B-M1 – Wet Well and Vault Plan with the attached version.

REPLACE Sheet 3B-E4 – Electrical Building Plans with the attached version.

REPLACE Sheet 3B-E6 – Soft Starter Panel Layout with the attached version.

REPLACE Sheet 3B-E8 – Pump Disconnect Panel with the attached version.

ITEM NO. 16 – SCHEDULE C - SHEETS

*Sheets replaced for visual clarity only, content remains unchanged

REPLACE Sheet 3C-G2 – Design Data Table and System Curve with the attached version.

REPLACE Sheet 3C-C4 – Site Plan with the attached version.

REPLACE Sheet 3C-E4 – Elevation Details with the attached version.

REPLACE Sheet 3C-E6 – Soft Starter Panel Layout with the attached version.

REPLACE Sheet 3C-E8 – Pump Disconnect Panel with the attached version.

ITEM NO. 17 – SCHEDULE D - SHEETS

*Sheets replaced for visual clarity only, content remains unchanged

REPLACE Sheet 3D-E6 – Circuit and Panel Schedules with the attached version.

REPLACE Sheet 3D-E7 – VFD Panel Layout with the attached version.

REPLACE Sheet 3D-E9 – Pump Disconnect Panel with the attached version.

REPLACE Sheet 3D-E10 – Lighting Plan with the attached version.

ADDENDUM NO. 2

TO THE

CONTRACT DOCUMENTS

FOR

PUMP STATION REHABILITATION AND UPGRADES PROJECT –
GROUP 3

FOR

CLACKAMAS COUNTY WATER ENVIRONMENT SERVICES

OREGON CITY, OREGON

THIS ADDENDUM IS HEREBY MADE A PART OF THE CONTRACT DOCUMENTS TO THE SAME EXTENT AS THOUGH IT WERE ORIGINALLY INCLUDED THEREIN.

BIDDERS MUST ACKNOWLEDGE RECEIPT OF ALL ADDENDA ON THE BID PROPOSAL FORM. BID PROPOSALS THAT FAIL TO ACKNOWLEDGE ALL ADDENDA MAY BE CONSIDERED IRREGULAR AND MAY BE REJECTED.

ISSUED THIS 18th DAY OF AUGUST, 2025.

CONSOR NORTH AMERICA
One SW Columbia Street Suite 1700
Portland, Oregon 97204
(503) 225-9010

VOLUME 2 of 3

ITEM NO. 1 – SECTION 43 21 00 – LIQUID PUMPS

REPLACE Subsection 2.5-A.3.e with the following:

Pump test data curves showing head, flowrate, bhp and efficiency. Acceptance level shall be Grade 1U as defined in ANSI/HI 14.6.

REPLACE Subsection 2.1-A.1a with the following:

Xylem, Flygt, Model NP 3153 HT with MiniCAS II monitoring and status unit.

REPLACE Subsection 2.1-B.1.a with the following:

Xylem, Flygt, Model NP 3127 HT with MiniCAS II monitoring and status unit.

REPLACE Subsection 2.1-C.1.a with the following:

Xylem, Flygt, Model NP 3127 HT with MiniCAS II monitoring and status unit.

REPLACE Subsection 2.1-C.1.a with the following:

Xylem, Flygt, Model NP 3202 HT with MiniCAS II monitoring and status unit.

REPLACE Subsection 2.1-A.6 Pump System Dimensions with the following:

Minimum Pump Discharge Size	4-inch
Base Elbow Discharge Size	4-inch
Discharge Flange Rating (ANSI)	Class 125
Minimum Submersible Cable Length	As Required

VOLUME 3 of 3

ITEM NO. 2 – SCHEDULE A – SHEET 3A-C3

ADD the following to the sheet notes:

6. Bypass suction and discharge piping to be fused HDPE DR 17 and to utilize restrained joints.

ITEM NO. 2 – SCHEDULE A – SHEET 3A-C6

ADD the following to the sheet notes:

4. Sod that is damaged during construction shall be replaced and restored to pre-construction conditions.

ITEM NO. 3 – SCHEDULE A – SHEET 3A-C7

REMOVE Callout "CONSTRUCTION STAGING AREA, SEE SHT NOTE 1"

REMOVE Linework referenced by Callout "CONSTRUCTION STAGING AREA, SEE SHT NOTE 1"

REPLACE Sheet Note 1 with the following:

1. Contractor shall secure its own staging area as needed.