

ADDENDUM NO. 3

CITY OF PENDLETON

Airport Reservoir and Booster Pump Station Project

Issued: December 2, 2021

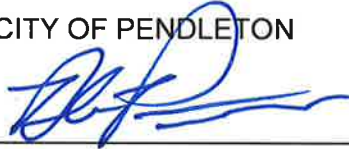
Original Bid Opening Date: DECEMBER 9, 2021 @ 2:00 pm

Revised Bid Opening Date: DECEMBER 16, 2021 @ 2:00 pm

TO ALL PLANHOLDERS:

This Addendum provides the following clarifications/revisions, corrections and changes to the Bid Documents. All bidders shall acknowledge receipt and acceptance of this Addendum by completing the spaces and signing where indicated below and submitting it with the Proposal. Bids submitted without signing for the Addendum may be considered informal.

CITY OF PENDLETON



Bob Patterson, PE
Public Works Director
City of Pendleton
500 SW Dorion Avenue
Pendleton, OR 97801

BIDDER'S ACKNOWLEDGMENT:

Company Name (please print)

Bidder's Name (please print)

Signature

Title

Address

City, State

ADDENDUM NO. 3
TO THE
CONTRACT DOCUMENTS
FOR
NEW AIRPORT RESERVOIR AND BOOSTER STATION
FOR
THE CITY OF PENDLETON, 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 2ND DAY OF DECEMBER 2021.



MURRAYSMITH
888 SW 5th, Suite 1170
Portland, OR 97204
(503) 225-9010

ITEM NO. 1 - INFORMATION FOR BIDDERS, SECTION 1, INVITATION TO BID

- A. On Invitation to Bid, page 1 of 2, Paragraph 1, **DELETE** the first sentence, which begins with “Sealed bids for...”, in its entirety and **REPLACE** with the following:

“Sealed bids for the **Airport Reservoir and Booster Pump Station Project** will be received by the City of Pendleton c/o Bob Patterson, Public Works Director, City of Pendleton, 500 SW Dorion Avenue, Pendleton, OR 97801 no later than **2:00 pm local time on the 16th day of December 2021**, plainly marked “**Airport Reservoir and Booster Pump Station Project**”.

- B. On Invitation to Bid, page 1 of 2, **DELETE** Paragraph 4, which begins with “All bidders must be prequalified...”, in its entirety and **REPLACE** with the following:

“All bidders must be prequalified for the class of work included in this Bid Document in accordance with the laws of the State of Oregon and all prequalification applications must be submitted to the City by **1:00 pm Wednesday, December 8, 2021**. (See Section 4.00)”

ITEM NO.2 - INFORMATION FOR BIDDERS, SECTION 1, INFORMATION FOR BIDDERS

- A. On Information for Bidders, page 1 of 4, **DELETE** Paragraph 2, which begins with “Bids are expected to be opened...”, in its entirety and **REPLACE** with the following:

“Bids are expected to be opened **2:00 pm, local time, Thursday, December 16, 2021**. Bid award, after seven (7)-day notice of intent to award declaration, will likely take place on Tuesday, January 4, 2022, at the regularly scheduled City Council meeting.”

- B. On Information for Bidders, page 2 of 4, Paragraph 5, **DELETE** the first sentence, which begins with “Bidders must submit...”, in its entirety and **REPLACE** with the following:

“Bidders must submit the following completed documents with their bids by the bid due date (**December 16, 2021**) and time (**2:00 pm**) indicated on the Invitation to Bid (Section 1.00) or as stated on any addendum(s) stating otherwise.”

ITEM NO. 3 - INFORMATION FOR BIDDERS, SECTION 5, PROPOSAL

- A. On Proposal, page 1 of 14, **DELETE** Paragraph 6, which begins with “In the event the Bidder...”, in its entirety and **REPLACE** with the following:

“In the event the Bidder is awarded the Contract and shall fail to complete the work within the time limit or extended time limit agreed upon, as more particularly set forth in the Contract Documents, liquidated damages shall be paid the City of Pendleton, Oregon, at the rate of one percent (1%) per calendar day of the price of contract work not yet

completed, or \$500.00 per calendar day, whichever is greater, for work not completed **by April 14, 2023**. Sundays and legal holidays shall be excluded in determining days of default.”

- B. On page 1 of 14, Paragraph 9, **DELETE** the first sentence, which begins with “Bidders must submit the following...”, in its entirety and **REPLACE** with the following:

“Bidders must submit the following completed documents with their bids by the bid due date (**December 16, 2021**) and time (**2:00 pm**) indicated on the Invitation to Bid (Section 1.00) or as stated on any addendum(s) stating otherwise.”

- C. On page 3 of 14, Paragraph 1, **DELETE** the first bulleted sentence, which begins with “Prequalification must be submitted...”, in its entirety and **REPLACE** with the following:

“Prequalification must be submitted by 1:00 pm, December 8, 2021.”

ITEM NO. 4 – INFORMATION FOR BIDDERS, SECTION 6, BIDDER’S QUALIFICATIONS

- A. On Bidder’s Qualifications, page 1 of 4, following the listing of qualified Reservoir Contractors and Tank Painting Contractors, **ADD** the following paragraphs noting qualified Transmission Main Contractors and Controlled Blasting Contractors for the project:

“Transmission Main Contractors:

1. Rotschy, Inc.
2. Crestline Construction Company, LLC
3. Quesenberry Construction, Inc.

Controlled Blasting Contractors:

1. McCallum Rock Drilling, Inc.
2. Aggregate Resource Drilling, LLC”

ITEM NO. 5 - CITY OF PENDLETON, FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM

- A. **DELETE** the City of Pendleton, First-Tier Subcontractor Disclosure Form in its entirety and **REPLACE** with the attached copy of the City of Pendleton, First-Tier Subcontractor Disclosure Form.

ITEM NO. 6 - SPECIFICATION SECTION 08 80 00, GLAZING

- A. On page 08 80 00-10, subsection 3.8, Monolithic Glass Schedule, **DELETE** in its entirety subsection 3.8.A, which begins “A. Glass Type: Clear annealed...” and **REPLACE** with the following:

- “A. Glass Type: Clear, fully tempered float glass, fire rated for 2-hour wall assembly.
1. Thickness: 6.0mm
 2. 2hr fire rating to ASTM E119 or UL 293
 3. Provide safety glazing labeling.
 4. Provide fire rating labeling.”

ITEM NO. 7 - SPECIFICATION SECTION 13 05 41, SEISMIC REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS AND SYSTEMS

- A. **ADD** the attached Section 13 05 41, SEISMIC REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS AND SYSTEMS, in its entirety.

ITEM NO. 8 – SPECIFICATION SECTION 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL

- A. **DELETE** Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, in its entirety and **REPLACE** with the attached copy of this Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

ITEM NO. 9 – SPECIFICATION SECTION 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

- A. On page 26 05 19-2, Subsubsection 2.2.C, Power Limited Wiring, **DELETE** paragraphs 10(b) & 10(c), which begin with “b. Installation: Install in accordance...” and “c. Testing: Test in accordance”, respectively, in their entirety and **REPLACE** with the following:

“b. Install and test in accordance with Section 3 of this specification.”

- B. On pages 26 05 19-3, Subsubsection 2.2 D, Cable System Identification: DC2, **DELETE** paragraphs 7(b) & 7(c), which begin with “b. Installation: Install in accordance...” and “c. Testing: Test in accordance”, respectively, in their entirety and **REPLACE** with the following:

“b. Install and Test in Accordance with Section 3 of this specification.”

ITEM NO. 10 – SPECIFICATION SECTION 26 05 29, HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- A. On page 26 05 29-3, Subsubsection 2.1.C, Suspended Raceway Supports and Racks, **DELETE** Paragraph 2, which begins with “Hanger rods shall be...” in its entirety and **REPLACE** with the following:

“ 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 Section 13 05 41, Seismic Requirements for Non-Structural Components and Systems.”

- B. On page 26 05 29-4, **DELETE** Subsection 2.3, Anchor Bolts, in its entirety.

ITEM NO. 11 – SPECIFICATION SECTION 26 05 33, CONDUITS, RACEWAYS, BOXES, AND FITTINGS

- A. On page 26 05 33-2, Subsubsection 2.4.A, GRC, **DELETE** Paragraph 2, which begins with “Threaded Bushings...”, in its entirety and **REPLACE** with the following:

“2. Threaded Bushings: 1 1/4-inch and larger, insulated, grounding type as required under Section 26 05 26, Grounding.”

ITEM NO. 12 - SPECIFICATION SECTION 26 05 73, POWER SYSTEM STUDIES

- A. On page 26 05 73-15, Subsection 3.2, FIELD QUALITY CONTROL, **DELETE** Subsubsection 3.2.A, which reads “Refer to Section 26 05 00”, in its entirety.

ITEM NO. 13 - SPECIFICATION SECTION 26 08 10, ELECTRICAL SYSTEM TESTING AND SETTINGS

- A. **ADD** the attached Section 26 08 10, ELECTRICAL SYSTEM TESTING AND SETTINGS, in its entirety.

ITEM NO. 14 – SPECIFICATION SECTION 26 24 16, PANELBOARDS

- A. On page 26 24 16-1, **DELETE** Paragraph 1.4.A-1, which begins with “Final as-built drawings...”, in its entirety and **REPLACE** with the following:

“1. Final as-built drawings and information for all required items, and shall incorporate all changes made during the manufacturing process.”

- B. On page 26 24 16-2, **DELETE** Subsection 2.1, MANUFACTURERS, in its entirety and **REPLACE** with the following:

“2.1 MANUFACTURERS

- A. Square D
- B. Siemens
- C. Approved Equal

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.”

ITEM NO. 15 – SPECIFICATION SECTION 26 24 19, MOTOR CONTROL CENTERS

- A. **ADD** the attached Section 26 24 19, MOTOR CONTROL CENTERS, in its entirety.

ITEM NO. 16 – SPECIFICATION SECTION 26 27 00, SERVICE AND DISTRIBUTION.

- A. On page 26 27 00-2, Subsection 1.4, ELECTRICAL SERVICE, **DELETE** Subsubsection F, which begins with “The Contractor shall pay...”, and **REPLACE** with the following:

“F. The City of Pendleton shall pay all Power Company fees.”

ITEM NO. 17 – SPECIFICATION SECTION 26 29 24, ACTIVE FRONT END LOW VOLTAGE ADJUSTABLE FREQUENCY DRIVES

- A. **DELETE** Section 26 29 24, ACTIVE FRONT END LOW VOLTAGE ADJUSTABLE FREQUENCY DRIVES, in its entirety and **REPLACE** with the attached copy of this Section 26 29 24, ACTIVE FRONT END LOW VOLTAGE ADJUSTABLE FREQUENCY DRIVES.

ITEM NO. 18 - SPECIFICATION SECTION 26 36 23, AUTOMATIC TRANSFER SWITCHES

- A. **DELETE** Section 26 36 23, AUTOMATIC TRANSFER SWITCHES, in its entirety and **REPLACE** with the attached copy Section 26 36 23, AUTOMATIC TRANSFER SWITCHES.

ITEM NO. 19 – SPECIFICATION SECTION 26 43 13, SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

- A. **ADD** the attached Section 26 24 19, SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS, in its entirety.

ITEM NO. 20 – SPECIFICATION SECTION 26 50 00, LIGHTING

- A. On page 26 50 00-4, Subsubsection 1.5.B, Product Data, **DELETE** Item b(14)(a), which begins with “Support methods shall be based on...”, in its entirety and **REPLACE** with the following:
- “a) Support methods shall be based on seismic requirements at the project site as specified in Section 13 05 41, Seismic Requirements for Non-Structural Components and Systems.”
- B. On page 25 50 00-11, **DELETE** Subsection 3.5, DEMONSTRATION AND TRAINING, in its entirety.

ITEM NO. 21 - SPECIFICATION 33 16 23, GROUND-LEVEL STEEL WATER STORAGE TANK

- A. Bidder question:
- Contract drawings for the water reservoir appear to provide details for a fully designed reservoir, including ringwall foundation, tank steel plate thickness and tank appurtenances. Specification section 33 16 23, includes language in several areas indicating that the ‘design’ is to be included as part of the contractor’s scope of work. Specifications also say for the contractor is to bid based on the details and requirements of the contract documents. Please confirm whether the tank contractor is responsible for providing a PE Stamped final design for the new water reservoir.*

Engineer response:

Project technical specifications and drawings provide a reservoir design that meets current code requirements for permitting. Additionally, project technical specifications and drawings provide a reservoir design using minimum design requirements for bidding purposes. If the project’s selected Reservoir Contractor proceeds with development of shop drawings based on the provided project designs, then the Reservoir Contractor does not need to provide stamped calculations, only shop/fabrication drawings for review. The project’s selected Reservoir Contractor can propose an “or equal” design if they supply stamped calculations and drawings for review and approval at the Owner’s (or Owner’s Representative) discretion.

- B. For additional clarification on the minimum design requirements for proposed “or equal” designs, refer to the second sentence of Section 33 16 23-1.3.A, copied below:

“The basis for design of this welded steel reservoir shall be in accordance with AWWA D100-11, Section 3.”

Note designs based on AWWA D100-11, Section 14 will not be an acceptable “or equal” design.

- C. For additional clarification on the provided reservoir roof designs, see Addendum No. 3, Item No. 26 - DRAWINGS, RES-S-3, RESERVOIR ELEVATION AND FOUNDATION PLAN.
- D. On page 33 16 23-2, Paragraph 1.3.B(2), Seismic Loads, **DELETE** the first paragraph, which begins with “The ground supported steel reservoir...”, in its entirety and **REPLACE** with the following:

“The ground supported steel reservoir and all related components shall be designed and constructed to resist all seismic forces under both full (at overflow) and empty conditions. Per AWWA D100-11 Sec. 3 **for Seismic Site Class B**, the seismic design factors shall be applied as noted in Sheet S-1 of the Drawings.”

ITEM NO. 22 - SPECIFICATION SECTION 40 67 00, PROCESS CONTROL PANELS AND HARDWARE

- A. On page 40 67 00-3, Subsubsection 1.2.A, References, **DELETE** Subparagraph 4(a), which reads “Section 26 05 00, General Electrical Requirements”, in its entirety and **REPLACE** with the following:
 - “a. Section 26 05 00, Common Work Results for Electrical”
- B. On page 40 67 00-5, Subsection 1.4, ENVIRONMENTAL CONDITIONS, **DELETE** Subsubsection A, which reads “Section 26 05 00, General Electrical Requirements”, in its entirety and **REPLACE** with the following:
 - “A. Section 26 05 00, Common Work Results for Electrical”

ITEM NO. 23 – SPECIFICATION SECTION 40 78 19, SWITCHES AND PUSH BUTTONS

- A. **ADD** the attached Section 40 78 19, SWITCHES AND PUSH BUTTONS, in its entirety.

ITEM NO. 24 - SPECIFICATION SECTION 41 22 13, OVERHEAD BRIDGE CRANE SYSTEM

- A. On page 41 22 13-2, Subsubsection 2.1.C, Design Criteria, **DELETE** the seventh row of the table, which begins with “Length of Runway...”, in its entirety and **REPLACE** with the following:

Length of Runway	35’-8” +/-
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ITEM NO. 25 - DRAWINGS, EROSION AND SEDIMENT CONTROL

- A. **REPLACE** Sheet ESC-1, EROSION AND SEDIMENT CONTROL PLAN, COVER SHEET, with the attached Sheet ESC-1, EROSION AND SEDIMENT CONTROL PLAN, COVER SHEET.
- B. **REPLACE** Sheet ESC-2, EROSION AND SEDIMENT CONTROL PLAN, ESC PLAN OVERVIEW, with the attached Sheet ESC-2, EROSION AND SEDIMENT CONTROL PLAN, ESC PLAN OVERVIEW.
- C. **ADD** the attached Sheet ESC-4B, EROSION AND SEDIMENT CONTROL PLAN, SCHEDULES A & B - EXCAVATED AND BLASTED ROCK MATERIALS DISPOSAL.

Item No. 26 - DRAWINGS, RES-S-3, RESERVOIR ELEVATION AND FOUNDATION PLAN

- A. Bidder question:
We are requesting additional information as for how the specified 5/8" thick roof is designed. Are the plates to be butt or lap weld? Is umbrella system acceptable (rolled in one direction)? What about the dollar plate at the center; can this be coned (roll formed) or must it be bumped (double pressed) plate?

Engineer response:

Based on the API Standard 650, a roof plate thickness of 5/8 inches should be butt weld due to geometric constraints. Note that the Owner requires a dome roof, therefore an umbrella system is not acceptable, and a dollar plate is not applicable.

- B. Bidder question:
What is the City's acceptance criteria for alternate roof designs?

Engineer response:

Alternate dome roof designs must meet the current design requirements of AWWA D100 and meet the same design performance objectives as provided in the project design drawings for ease of coating and maintenance. For further clarification, alternate details that will be more difficult to coat/maintain may be rejected, even if they meet current code requirements.

Item No. 27 - DRAWINGS, RES-S-4, RESERVOIR FOUNDATION, SHELL AND ROOF DETAILS

- A. Bidder question:
Contract drawing sheet RES-S-4, detail D, illustrates the roof perimeter joint at the rim angle. Details calls for a 1/2-inch thickness fillet weld on the interior and exterior roof plate edge on the rim angle. Detail also shows a piece of FB covering the inside joint. Please confirm whether the 1/2-inch thickness fillet weld is required to seal weld the

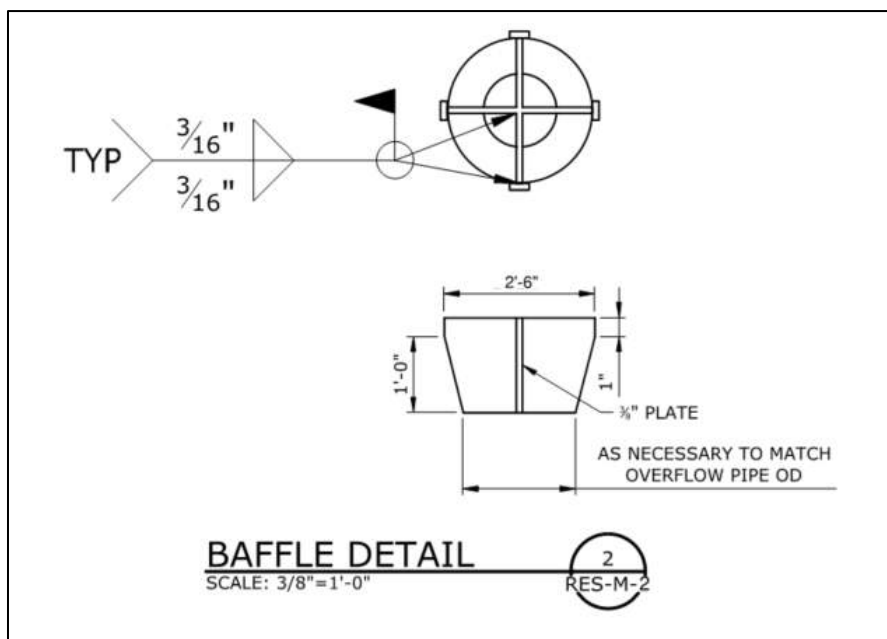
interior roof plate connection at the rim angle, or the flat bar cover plate is required.
Please advise.

Engineer response:

The outer 1/2-inch thickness fillet weld to the rim angle is required for the roof.
The inner weld is for the plate that closes off the small space between the interior of the roof plate and the interior of the rim angle. This area is narrow and difficult to paint/seal, which creates a corrosion concern. This plate is non-structural and can be omitted with an alternate detail that addresses the potential corrosion concern, if desired. Review and approval of the alternate detail will be at the Owner's/Engineer's discretion.

ITEM NO. 28 - DRAWINGS, RES-M-3, RESERVOIR MISCELLANEOUS MECHANICAL DETAILS

- A. **DELETE** Detail 2, BAFFLE DETAIL, and **REPLACE** with the revised Detail 2, BAFFLE DETAIL, below.



ITEM NO. 29 - DRAWINGS, BPS-S-3, PUMP STATION, ROOF FRAMING PLANS & BUILDING SECTIONS

- A. On TRANSVERSE SECTION A, at the bottom right corner of the detail, **DELETE** the dimension of 1'-10" at the thickened edge of the building slab and footing.
- B. On TRANSVERSE SECTION B, at the bottom right corner of the detail, **DELETE** the dimension of 1'-10" at the thickened edge of the building slab and footing.

ITEM NO. 30 - DRAWINGS, BPS-H-1, BOOSTER PUMP STATION, HVAC FLOOR PLAN AND SCHEDULES

- A. In the LOUVER SCHEDULE, **DELETE** Row 2 for Louver L-2 in its entirety.

ITEM NO. 31- DRAWINGS, BPS-E-5, ELECTRICAL SITE PROXIMITY PLAN

- A. In Note 1, **DELETE** the second sentence, which begins with "REVIEW THIS DOCUMENT...", in its entirety and **REPLACE** with the following:

"REVIEW THIS DOCUMENT PRIOR TO BID."

- B. For further clarification on Note 1, the City of Pendleton will pay all electrical utility charges directly.

- C. For the callout which reads:

" 4" DIAM. SCHEDULE 80 PVC,
GREY CONDUIT"

ADD the following to the end of the callout:

"PROVIDE WITH LONG SWEEP FIBERGLASS ELBOWS"

ITEM NO. 32 - DRAWINGS, BPS-E-6, ELECTRICAL, ONE LINE DIAGRAM

- A. **DELETE** Drawing BPS-E-6, ELECTRICAL, ONE LINE DIAGRAM, in its entirety and **REPLACE** with the attached Drawing BPS-E-6, ELECTRICAL, ONE LINE DIAGRAM.

ITEM NO. 33 - DRAWINGS, BPS-E-7, ELECTRICAL, GROUNDING PLAN

- A. In GROUNDING NOTES, **DELETE** Note 3 in its entirety.
- B. In GROUNDING NOTES, **DELETE** Note 7 in its entirety.
- C. **DELETE** the callout in upper right corner of PLAN which reads:

"#6 BARE CU.
SEE NOTE 10"

and **REPLACE** with:

"#6 BARE CU.
SEE NOTE 6"

ITEM NO. 34 - DRAWINGS, BPS-E-8, ELECTRICAL, LIGHTING

- A. **DELETE** Drawing BPS-E-8, ELECTRICAL, LIGHTING, in its entirety and **REPLACE** with the attached Drawing BPS-E-8, ELECTRICAL, LIGHTING.

ITEM NO. 35 - DRAWINGS, BPS-E-10, ELECTRICAL, POWER AND CONTROL PLAN

- A. **DELETE** Drawing BPS-E-10, ELECTRICAL, POWER AND CONTROL PLAN, in its entirety and **REPLACE** with the attached Drawing BPS-E-8, ELECTRICAL, POWER AND CONTROL PLAN.

ITEM NO. 36 - DRAWINGS, BPS-E-11, ELECTRICAL. DISTRIBUTION PANEL 'PP-1' SCHEDULE AND FIXTURE SCHEDULE

- A. In the LIGHT FIXTURE AND LUMINAIRE SCHEDULE, for the Stanchion Mount Light:
1. In DESCRIPTION, **ADD** "WITH PHOTOCELL".
 2. In SUGGESTED MANUFACTURER AND CATALOG NUMBER, **DELETE** current item in its entirety and **REPLACE** with the following:

"CROUSE-HINDS PVM7L-D2S20 OR EQUAL"

ITEM NO. 37 - DRAWINGS, BPS-E-14, ELECTRICAL, CABLE SCHEDULE - 1

- A. **DELETE** Drawing BPS-E-14, ELECTRICAL, CABLE SCHEDULE - 1, in its entirety and **REPLACE** with the attached BPS-E-14, ELECTRICAL, CABLE SCHEDULE -1.

ITEM NO. 38 - DRAWINGS, BPS-E-15, ELECTRICAL, CABLE SCHEDULE - 2

- A. For Circuit Numbers C-P1001 through C-P1005, in the RACEWAY column, **DELETE** "(3/4)" and **REPLACE** with "(1.25)".
- B. For Circuit Numbers C-P1006 and C-P1007, in the RACEWAY column, **DELETE** "(3/4)" and **REPLACE** with "(1.00)".
- C. **ADD** the following row to the Cable Schedule:

C-PMM – from – MCC-1 – Power Monitor – to – PLC control panel – ¾” conduit containing one CAT 6 cable.

ITEM NO. 39 - DRAWINGS, BPS-I-1, INSTRUMENT LOCATION PLAN

A. **DELETE** Circuit “C-ANT-1”.

1. Correct antenna location is depicted on Drawing BPS-E-9, Note 5.

**CITY OF PENDLETON
FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM**

Bids which are submitted by Bid Closing, but for which a required disclosure submittal has not been made by the specified Disclosure Deadline, are not responsive and shall not be considered for Contract award.

AGENCY SUPPLIED INFORMATION:

Project Name: Airport Reservoir and Booster Pump Station
 Bid Closing Date: December 16, 2021 Time: 2:00 pm
 Disclosure Deadline Date: December 16, 2021 Time: 4:00 pm

THIS DISCLOSURE FORM MUST BE SUBMITTED to the City of Pendleton at the location specified and in accordance with the date and time in the Advertisement for Bids. A separate form must be submitted for each Schedule. If necessary, use additional forms to satisfy the Disclosure requirements.

The contracting agency will insert "N/A" if the contract value is not anticipated to exceed \$100,000, otherwise, this form must be submitted either with the bid or within two (2) working hours after the advertised bid closing date and time; but no later than the Disclosure Deadline stated above.

List below the NAME, ADDRESS, DOLLAR VALUE, CONSTRUCTION CONTRACTOR BOARD (CCB) NUMBER, CONTACT NAME and TELEPHONE NUMBER of each Subcontractor that will be furnishing labor and/or materials that are required to be disclosed in accordance with ORS 279C.370.

ENTER "NONE" IF THERE ARE NO SUBCONTRACTORS THAT NEED TO BE DISCLOSED.
 (Attach additional sheets if needed)

<u>NAME/ADDRESS OF SUBCONTRACTORS</u>	<u>\$ VALUE/CCB #</u>	<u>CONTACT NAME/PHONE #</u>
1) _____ _____	\$ _____ CCB# _____	_____ _____
2) _____ _____	\$ _____ CCB# _____	_____ _____
3) _____ _____	\$ _____ CCB# _____	_____ _____

The above listed first-tier subcontractor(s) are providing labor and/or materials with a Contract value equal to or greater than:

- a) 5% of the total project amount proposed or \$15,000, whichever is greater; or
- b) \$350,000, regardless of the percentage of the total project amount proposed.

Disclosure submitted by: _____
Signature – Bidder Name

Contact Name: _____ _____
Print/type – Bidder Name Phone Number

Unless otherwise stated in the original solicitation, this document shall not be faxed. It is the responsibility of the Bidder to separately submit this Disclosure Form and any additional sheets with the Project Schedule and Name clearly marked in accordance with the date and time in the Advertisement for Bids.

SECTION 13 05 41

SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS AND SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes architectural, plumbing, mechanical, and electrical building components and systems, non-structural components, and non-building structures that are designed and constructed for seismic demands. Exempt components include those that are specifically exempted in ASCE 7 and the items below:
 - a. Temporary or movable equipment.
 - b. Furniture, except storage cabinets greater than 6' tall
2. Design, detail and provide complete seismic restraint and anchorage systems.
3. Provide equipment and product certifications to be submitted for review by the Owner. The following systems and components are Designated Seismic Systems and specifically require Special Certification per ASCE 7-16, Section 13.2:
 - a. Electrical Equipment:
 - 1) Motor control centers (MCCs)
 - 2) I&C panels and cabinets
 - 3) Variable frequency drives (VFDs)
 - 4) Switchgears
 - 5) Automatic transfer switches
 - 6) Standby generators
 - 7) Electrical panels
 - 8) Transformers
 - b. Mechanical Equipment:
 - 1) Chemical pumps
 - 2) Aquifer storage and recovery valve control panels
 - 3) Ventilation fans and ducts
 - c. Components with Hazardous Substances:
 - 1) Diesel storage tanks
 - 2) Chemical storage tanks and saturators

- d. Distribution Systems
 - 1) Piping
 - 2) Valves
 - 3) Flowmeters
 - 4) Vertical turbine pumps
- e. Other Equipment and Components:
 - 1) Fabricated fiberglass enclosures

1.2 DEFINITIONS AND ABBREVIATIONS

- A. Anchorage: Connection to structure typically through the use of welding, bolts, screws, anchor bolts, post-installed anchors or other fasteners selected to meet the Building Code.
- B. Authority Having Jurisdiction (AHJ): The governmental agency or sub-agency that regulates the construction process. This may be a local building department, state agency, federal entity or other body or bodies having statutory authority.
- C. Code or Building Code: Building Code currently in effect where the Project is located. For the purposes of this project, the term Building Code collectively refers to: 2019 OSSC, ASCE 7-16, 2018 IBC ASCE 41-17, and 2014 OSSC (In the order listed).
- D. Designated Seismic System: Those architectural, electrical, and mechanical systems and their components that require seismic design or qualification in accordance with ASCE 7 and for which the component importance factor, I_p , is 1.5 according to ASCE 7.
- E. International Accreditation Service, Inc. (IAS).
- F. International Building Code (IBC).
- G. International Code Council Evaluation Service (ICC-ES).
- H. Inspection Agency: Organization or individual accredited to ISO 17020 and regularly engaged in factory inspection services for seismic restraint or qualification of non-structural components and equipment.
- I. California Office of Statewide Health, Planning and Development (OSHPD).
- J. Oregon Structural Specialty Code (OSSC)
- K. Nonstructural Component: A part or element of an architectural, electrical, or mechanical system permanently attached to a structure including its supports and attachments.

- L. Restraint/Bracing: Bracing or anchorage used to limit movement under seismic forces. Cables or rigid elements, i.e., strut, pipe, and angles, used to resist forces by uniaxial tension or compression. Term "bracing" may also be used to describe design to resist lateral forces through the use of wall or frame elements.
- M. Seismic Deformations: Drifts, deflections and relative displacements determined in accordance with the applicable seismic requirements of the Building Code.
- N. Seismic Demand: Forces and deformations caused by a Code seismic event that must be resisted or accommodated by a structure, component, or system.
- O. Seismic Forces: Forces acting in any direction due to the action of an earthquake as defined in the Building Code.
- P. Seismic Guidelines and Minimum Design Requirements (SGMDR).
- Q. Special Inspector: An IAS accredited OSSC Special Inspection Agency or qualified Professional Engineer who demonstrates competence, to the satisfaction of the building official (or Authority Having Jurisdiction (AHJ)), for inspection of the Designated Seismic System. The Owner will employ one or more Special Inspectors to provide periodic inspections during installation of Designated Seismic Systems.
- R. Structural Engineer of Record (SER).
- S. Support: Elements used to support the weight (gravity load) of an item. Where the support is located at a seismic brace, the element may also resist tension/compression reactions from the restraint system.
- T. Supporting structure: Typically, a building floor, roof, wall, etc.
- U. Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

1.3 REFERENCE STANDARDS

- A. American Concrete Institute (ACI):
 1. ACI 355.2 – Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary
 2. ACI 318 – Building Code Requirements for Structural Concrete including Chapter 17 – Anchoring to Concrete (2014)
 3. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary (2006)

4. ACI 350.3 – Seismic Design of Liquid-Containing Concrete Structures and Commentary (2006)
- B. American Society of Civil Engineers (ASCE)
 1. ASCE 7 – Minimum Design Loads for Building and Other Structures (2016)
 2. ASCE 41 - Seismic Evaluation and Retrofit of Existing Buildings (2017)
 - C. ASTM International
 1. ASTM E488 – Standard Test Methods for Strength of Anchors in Concrete Elements
 - D. Electric Power Research Institute (EPRI)
 1. Experience-based Seismic Equipment Qualification, EPRI Report # 1016125 (EPRI Project Manager R. Kassawara), December 2007.
 - E. Federal Emergency Management Agency (FEMA):
 1. FEMA 461 – Interim Testing Protocols for Determining the Seismic Performance Characteristics of Structural and Nonstructural Components
 - F. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
 1. IEEE C37.81 - Guide for Seismic Qualification of Class 1E Metal-Enclosed Power Switchgear Assemblies (2017)
 - G. International Code Council (ICC)
 1. 2019 Oregon Structural Specialty Code (2019 OSSC)
 2. 2014 Oregon Structural Specialty Code (2014 OSSC)
 3. 2018 International Building Code (2018 IBC)
 - H. International Code Council Evaluation Service (ICC-ES)
 1. AC156 Seismic Certification by Shake-table Testing of Nonstructural Components”, Approved October 2010; editorially revised May 2015.
 - I. International Organization for Standardization (ISO)
 1. ISO/IEC 17020 – Conformity assessment -- Requirements for the operation of various types of bodies performing inspection (2012; reviewed and confirmed in 2017)
 - J. National Fire Protection Association (NFPA)
 1. NFPA 13 – Installation of Sprinkler Systems (2019)

- K. Office of Statewide Health, Planning and Development (OSHPD), California
 - 1. OSHPD Code Application Notice 2-1708A.5 – Certification of Equipment and Nonstructural Components
- L. Where reference is made to one of the above standards or guidance documents, the revision in effect by reference in the model code at the time of bid opening shall apply, unless otherwise noted.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Qualifications
 - 1. Professional Engineer Qualifications: Submit certification and experience documentation for the Professional Engineer performing engineering calculations to demonstrate compliance with the Special Seismic Certification requirements or other seismic calculations, indicating a minimum of 5 years' experience providing engineering services of the kind indicated when analysis or shake table testing is the justification for the Certification for each Designated Seismic System.
 - 2. Qualified Inspection Agency: A qualified IAS accredited Inspection Agency shall witness the shake table testing. Submit qualification of the qualified Inspection Agency, minimum 5-year experience records performing shake-table testing for Special Seismic Certification purpose, and qualifications of the inspection personnel overseeing the shake table testing.
- C. Shop Drawings:
 - 1. Delegated-Design Submittals: Prepare, seal, and sign seismic restraint and anchorage Shop Drawings consisting of design drawings and supporting calculations signed by a Professional Structural Engineer registered in the State of Oregon. Indicate restraint details including materials, quantities, anchor bolts, size and embedment of anchor bolts, base plate setting details and locations, and location, direction and magnitudes of project related loads transferred to the structure.
 - 2. Include sufficient information regarding the component attachments to verify compliance with applicable codes and standards.
 - 3. Use of proprietary restraint systems with a Certificate of Compliance verified and listed by an IAS accredited Inspection Agency is acceptable, provided that the seismic requirements for the project are met and the submittal has been reviewed and approved by SER.

D. Seismic Calculations:

1. Prepare, seal, and sign seismic calculations by a Professional Structural Engineer registered in the State of Oregon and submit with Shop Drawings.
2. Include sufficient information regarding component attachments to verify a continuous load path of sufficient strength and stiffness that demonstrates compliance with applicable codes and standards.

E. Special Seismic Certification of Designated Mechanical Equipment, Electrical Equipment, Distribution Systems, and other Equipment:

1. Each manufacturer of a Designated Seismic System shall submit a Certificate of Compliance, per of ASCE 7-16, Section 13.2.1.2, indicating the following:
 - a. Equipment and its components satisfy the seismic qualification requirements herein (in PART 2)
 - b. Seismic qualification was done in accordance with the qualification methods herein (in PART 3).
 - c. Components, their mounting system, and anchorage meet the Special Certification requirements per ASCE 7-16, Section 13.2, to withstand required seismic demands with a Component Importance Factor of 1.5 and are capable of immediately and fully functional/operable following the design earthquake per the seismic criteria in the SGMDR.
 - d. Basis for Certification: Indicate whether certification is based on actual test of assembled components, supports and attachments, or based on experience based seismic qualification, or on calculation/ analysis of them.
 - e. The entity (i.e., manufacturer or qualified testing agency) that performed the seismic qualification testing, and the qualified testing agency that witnessed the testing.
 - f. The professional engineer that performed the engineering calculations that demonstrate the compliance of the Special Seismic Certification requirements.
 - g. Dimensioned Outline Drawings of Component: Identify center of gravity and locate and describe mounting, supports and attachment provisions.
 - h. Specifications for, and drawings of, the component, supports and attachments as necessary to install component in a manner consistent with the certification shall be provided.

- i. If anchorage to concrete applies to component attachment, provide detailed description of anchorage products/ devices on which the certification is based and their installation requirements.
 - 1) The description must clearly indicate how the use of the products will result in compliance with the anchorage requirements of ACI 318.
2. Submit evidence and supporting materials associated with the Certificate of Compliance that demonstrates the functional seismic qualification, as follows:
 - a. When the qualification is by testing, supporting material shall include Seismic Qualification Report (SQR) including all data, results, and conclusions.
 - b. The SQR shall include the following content as a minimum:
 - 1) Title Page - The following information shall be shown on the title page:
 - a) Client
 - b) Supplier and Component Name
 - c) Specification Package Number/ Identification
 - d) Revision Number
 - e) Date
 - 2) General: A description of the component, its function and the method of qualification used to verify this function. In addition, the following information must be given:
 - a) Project and owner names.
 - b) Specification and purchase order numbers.
 - c) Component Name and Identification/number.
 - d) Organization(s) performing qualification programs.
 - 3) Data and Assumptions
 - a) Testing Section: The following data shall be included: Type of testing machine; Loads considered and simulated during the test; Methods used to simulate the supporting structure, details of the attachment to the supporting structure and/or testing machine; Position and orientation of setting component (photographs are recommended); Steps taken to monitor the function of component during the test and accelerometer locations and orientations (photographs are recommended); Means of generating test response spectra (if applicable);
 - b) Analytical Section: The following data shall be presented: Loads considered; Damping values used in the analysis; Codes and standards

used as bases for the analysis; Assumptions and engineering judgements made for idealizing boundary conditions, converting the load criteria to actual loads used for analyses/ calculations and converting the design criteria to actual stress, deformation and stability limits. Justification shall be provided for all assumptions and engineering judgements used; and A list of the computer programs and software revision numbers, to keep track of verification and validation (V&V), used in the analysis and the documentation which establish the validity of any computer program used, if not included in the public domain.

4) Qualification Procedure

- a) Testing Section: State type of test, wave form, frequency intervals and range, acceleration levels, axes of excitation, phase between inputs monitoring set-up and any other data to completely describe the input motion and show it is applied.
- b) Analytical Section: State the method used in the analysis, mathematical equations and their derivation from basic principles including appropriate references.

5) Results

- a) Testing Section: This section shall include the measurements obtained from the test and their interpretations. Findings and observations from monitoring the function of the component and/or inspection shall be presented. All results shall be presented in either numerical or graphical form.
- b) Analytical Section: Show actual design calculations and sketches for the mathematical models, including numbering used for the node points and numbers. If possible, show loads, resultant forces, moments, stresses, and deformations on the mathematical model of the component.

6) Supporting-Structure Loads

- a) The loads transmitted by the component to the supporting structure, calculated in the previous section, shall be presented in this section.

7) Conclusions

- a) Give a brief summary of the results obtained from the qualification program. A concise statement of the conclusion reached, which should satisfy the qualification requirements, shall be stated in this section.

8) Drawings and Specifications

- a) Include dimensioned outline drawings of component. Identify center of gravity and locate and describe mounting and attachment provisions.
 - b) Include drawings of, and specifications for, the component, supports and attachments as necessary to install component in a manner consistent with the certification shall be provided.
 - c) If anchorage to concrete applies to component attachment, provide detailed description of anchorage products/ devices on which the certification is based and their installation requirements. Description must clearly indicate how the use of the products will result in compliance with the anchorage requirements of ACI 318.
- c. When the qualification is by experience, supporting material shall include
- 1) Basis for the conclusion that the component meets the Special Seismic Certification requirements herein, through Qualification by Experience requirements established herein.
 - 2) Supporting engineering calculations signed and sealed by a Professional Structural Engineer registered in the State of Oregon and submitted to the Owner for acceptance.
- d. When the qualification is by analysis, supporting material shall include
- 1) Supporting engineering calculations signed and sealed by a Professional Structural Engineer registered in the State of Oregon and submitted to the Owner for acceptance.

1.5 QUALITY ASSURANCE

- A. Comply with the Oregon Structural Specialty Code (OSSC 2014 and 2019) and any modifications by the jurisdiction where the Project is located and applicable local and statewide adopted amendments.
- B. Special Seismic Certification: Provide Certification in accordance with OSSC, Chapter 17 and ASCE 7 Chapter 13 and 15 for Special Certification Requirements for Designated Seismic Systems.
- C. Provide Special Inspections for installation, inspection and testing of the following per OSSC Chapter 17:
 1. Designated seismic systems shall be examined and verify that the label, anchorage or mounting conforms to the certificate of compliance.

2. Architectural and Mechanical Components: Periodic special inspection in accordance with Section 1705.11.5 & 1705.11.6.
3. Seismic Isolation systems: Periodic special inspection in accordance with Section 1705.11.8.

1.6 FIELD QUALITY CONTROL

A. Special Seismic Certifications:

1. Verify that the label, anchorage, and mounting conform to the Certificate of Compliance for Designated Seismic Systems.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Provide seismic restraint of nonstructural components to withstand seismic demands without displacing or overturning.
- B. Provide non-building structures designed and constructed to withstand seismic demands as specified herein.
- C. For Designated Seismic Systems, provide installations capable of providing post-earthquake functionality.

2.2 PROJECT SEISMIC DESIGN CRITERIA

- A. Minimum Seismic Design Requirements: Per ASCE 7-16 and the following additional SGMDR requirements:
 1. Design Earthquake: Full MCE_R (i.e. no 2/3 factor to obtain design spectral acceleration)
 2. Risk Category: IV
 3. Seismic Importance Factor: 1.5
 4. Structural Performance Objective: Immediate Occupancy
- B. Seismic Design Parameters:
 1. $SS = 0.363$ g: Mapped Short Period Spectral Response Acceleration Parameter.
 2. $S1 = 0.137$ g: Mapped 1-second Spectral Response Acceleration Parameter.
 3. $SDS = 0.218$ g: Design Short Period Spectral Response Acceleration Parameter.
 4. $SD1 = 0.073$ g: Design 1-second Spectral Response Acceleration Parameter.

5. $I_e = 1.5$: Building or Structure Importance Factor.
 6. $I_P = 1.5$: Component Importance Factor.
- C. Seismic Design Category: C.
- D. Seismic Design Force: Base calculation of seismic design force on requirements of ASCE 7 including Chapter 11 through Chapter 15, and the seismic design parameters above.
- E. Seismic design forces for submerged components and equipment: Design of components and equipment that are submerged within tanks, reservoirs, water retention structures, etc. are to include the hydrodynamic forces. The forces due to hydrodynamic effects can be represented by the addition of an equivalent mass of water. Estimates of hydrodynamic forces shall be in accordance with ASCE 7-16, ACI 350.1-06, Goyal and Chopra (1989) described in USACE (2003).
1. Component analysis for columns and other compression members shall include secondary P-Delta effects caused by gravity and seismic loads.
 2. Components located above static fluid surfaces to be designed for hydrodynamic sloshing forces.
 3. If equipment components cannot be designed to resist hydrodynamic forces, the structural engineer for the equipment manufacturer shall predetermine strategic break points for approval by Engineer and Owner. The predetermined strategic break points shall be located such that these components can be easily replaced. In addition, flexible restraints (tethers) should be provided for “breakaway” components in order to keep broken elements off the structure’s floor.
- F. Seismic Relative Displacement:
1. Design of the structural separation shall accommodate seismic relative displacement of 0.015 times the story height in addition to thermal movement that may be present.
 2. Design of the non-structural components shall accommodate seismic relative displacement calculated per ASCE 7-16, Section 13.3.2.

2.3 SEISMIC QUALIFICATION REQUIREMENTS

- A. Qualification shall be based on testing, analysis or testing per ASCE 7 Chapter 13, as noted below, or a combination of analysis and testing per subsequent portions of this Section.
1. Shake table test data in accordance with ASCE 7-16 Section 13.2.5, per ICC-ES AC156 (ICC-ES 2015) testing standard procedure.

2. Experience data in accordance with ASCE 7-16 Section 13.2.6.
 3. Analysis according to sections 13.2 to 13.6 of ASCE 7-16 demonstrating compliance
- B. Qualification shall demonstrate that the component, and its support(s) and attachment(s), is capable of achieving the seismic performance requirement(s) indicated in the Project Seismic Design Criteria herein.
1. Seismic Performance Requirement: Position retention and functional/operable following the design earthquake per the seismic criteria in the SGMDR.
 2. The horizontal component of seismic load acting on a Designated Seismic Systems component shall be determined based on the Seismic Parameters provided herein and component response modification factor (R_p) parameters defined in ASCE 7-16, Section 13.3.1.

2.4 MATERIALS

- A. Anchor Bolts and Post-Installed Anchors:
1. Cast-in Anchor Bolts or Headed Studs: Use whenever possible and design in accordance with Section 1912 of the OSSC and ACI 318 Chapter 17. Do not use post-installed expansion anchors for critical fastening such as vibrating conditions and impact loads.
 2. Expansion or Sleeve Anchors: Pre-qualify for use in seismic applications per ASTM E488 and current ICC-ES evaluation reports.
 3. Adhesive Anchors: Pre-qualify for use in seismic applications per ASTM E488 and current ICC-ES evaluation reports.
 4. For components weighing over 400 pounds: Minimum 5/8-inch diameter anchor size with minimum 5-inch embedment.
 5. For components weighing less than 400 pounds: Minimum 3/8-inch diameter anchor size with minimum 3-inch embedment.

PART 3 EXECUTION

3.1 SEISMIC QUALIFICATION METHODS

- A. The seismic qualification of a component, to include its support(s) and attachment(s), is achieved by demonstrating it is capable of achieving its seismic performance requirement when subjected to the design earthquake per the seismic criteria specified herein. Regardless of the qualification program(s) chosen, the applicable

seismic performance requirements shall be as stated in the applicable table in PART 2 (herein). One of the following qualification methods shall be used:

1. Qualification by testing.
 2. Qualification by experience.
 3. Qualification by analysis.
 4. A combination of the aforementioned testing and analysis, for which there are two options:
 - a. Qualification testing supported by analysis (i.e., “supporting analysis”).
 - b. Qualification analyses supported by testing (i.e., “supporting tests”).
- B. Qualification by Testing:
1. The use of the qualification-testing method solely is appropriate when at least one of the following conditions apply:
 - a. The structural configuration of the component is extremely complex and/ or beyond the capability of mathematical modeling techniques.
 - b. The response of the component is expected to be significantly nonlinear.
- C. Qualification by Experience:
1. The use of the qualification-testing method solely is appropriate when at least one of the following conditions apply:
 - a. Component is listed on OSHPD Special Seismic Certification Preapproval (OSP) List
 - b. Component is listed on Seismic Qualification Utility Group (SQUG) database or on EPRI database and listed as “rugged” per EPRI’s experience-based qualification approach
- D. Qualification by Analysis:
1. The use of the qualification-analysis method solely is appropriate when at least one of the following conditions apply:
 - a. The structural configuration of the component is simple and/or within the capability of mathematical modeling techniques.
 - b. The response of the component is expected to be linear or exhibit simple nonlinear behavior.

- c. The effect of attached components and the superposition of load conditions are too complex for testing.
 2. The use of the qualification-analysis method for active parts or energized components of special-certification components that are active mechanical and electrical equipment is NOT permitted.
 3. When the qualification-analysis method is used, any/ all assumptions must be documented and justified.
- E. Qualification by testing supported by analysis:
 1. This method shall be considered only when it is known/ suspected that qualification solely by testing, or solely by analysis, is inadequate.
 2. The use of qualification testing supported by analysis is appropriate when at least one of the following conditions apply:
 - a. The component is too large to be qualified by solely by shake-table testing, thereby requiring a subsystem approach.
 - b. Subsystems of large, complex components can be qualified by testing individually, and the overall structural frame of the component can be evaluated by analysis.
- F. Qualification by analysis supported by testing:
 1. This method should be considered only when it is known/ suspected that qualification solely by testing, or solely by analysis, is inadequate.
 2. The use of qualification analysis supported by testing is appropriate when at least one of the following conditions apply:
 - a. The component is a system comprised of components for which qualification by analysis is appropriate, and of "subcomponents" for which qualification by analysis is inappropriate.
 - b. Systems with components that contain hazardous materials (e.g., tanks, piping, vessels, etc.) can be qualified by analysis, and operational valving or other active equipment can be evaluated by testing.
 3. Supporting tests may be used as follows:
 - a. To determine the deflection limits within which functionality/ operability is maintained (if not provided by the equipment manufacturer).

- b. To determine the dynamic parameters needed for constructing or verifying mathematical models.
- c. To determine the assumptions to be used in the analysis.
- d. To determine the amount of nonlinear response involved.

3.2 QUALIFICATION BY TESTING

- A. Qualification testing of all components shall be per ASCE 7 paragraph 13.2.5 and the following:
 - 1. Shake-table testing shall be done per ICC-ES AC156.
 - 2. Shake-table testing is mandatory for active parts or energized subcomponents of the following components:
 - a. Special-certification components that are active mechanical or electrical equipment.
 - b. Special-certification components with hazardous substances
 - c. If the component being qualified is connected to other components (in service), the qualification shall provide the permissible forces (e.g., nozzle loads, etc.) and, as applicable, anticipated displacements of the component at the connection points to facilitate assessment for consequential damage, in accordance with ASCE 7 paragraph 13.2.3.
 - 3. Verify shake table tests by an IAS accredited and qualified Inspection Agency or other independent inspection entity acceptable to the Authority Having Jurisdiction (AHJ) and Engineer.
 - 4. Label components with an identification applied on the product by manufacturer that contains manufacturer's name, function and performance characteristics of the product or material, and name and identification of accredited Inspection Agency. Indicate that representative sample of the product or material and its testing have been evaluated and listed by accredited Inspection Agency.
- B. Components meeting the shake table and/or seismic testing requirements of the following (and seismic requirements specified herein) are considered to meet the Special Seismic Certification requirements for the project:
 - 1. ANSI/AHRI Standard 1270
 - 2. IEEE Standard 344
 - 3. IEEE Standard 693
 - 4. ASME QME-1

3.3 QUAIFICATION BY EXPERIENCE

- A. Review the inclusion rules and caveats corresponding to the equipment class in the experience- based qualification database against the candidate component and establish the validity of application of the qualification by experience.
- B. Demonstrate by seismic analysis that the component's seismic capacity exceeds the seismic demand corresponding to the design seismic event per the seismic criteria in the SGMDR and specified herein, using one of the following approaches outlined in EPRI (2007):
 - 1. Simplified Method: Seismic equipment demand, calculated using the attachment height to building height ratio, is compared against a threshold spectral acceleration value of 1.2; this approach does not consider the natural frequency of the equipment.
 - 2. SQUG Method A: In this method, the design ground motion response spectrum is compared against the SQUG bounding spectrum for the seismic evaluation.
 - 3. SQUG Method B: In this method, the realistic median-centered in-structure response spectrum calculated for the design earthquake is compared with the SQUG Reference Spectrum.
- C. Evaluate any potentially significant seismic systems interaction concerns that may adversely affect component safe shutdown function and address such concerns.

3.4 QUALIFICATION BY ANALYSIS

- A. Include an evaluation of stress and deformation developed through the entire load path from the center of applied seismic load to equipment anchorage. Perform analysis considering dynamic characteristics and response spectrum required by this specification.
 - 1. Piping System and Ductwork: For distribution systems such as piping and ductwork, include a stress analysis of the pipe and duct, supports, bracing, and anchors. Include gravity and seismic demand stress analysis, an analytical assessment of connections, and consideration for movement of attachment points. In the analysis, consider the effects of in-line devices, where present.
 - a. Fire Protection Piping: Conformances with NFPA 13 will satisfy requirements for Special Seismic Certification.
- B. Qualification analysis of special-certification components shall be of adequate rigor such that the seismic performance requirement (e.g., containment of contents following the design earthquake per the seismic criteria) is demonstrated/ proven, and shall include the demands stipulated in ASCE 7 Chapter 13.

- C. The mathematical model used in qualification analyses shall include the “in-service” connectivity (to other components), support and attachment as applicable, and nonlinear models shall be used for all elements not responding linearly to the design seismic event.
- D. Capacity.
 - 1. Limiting strength(s) used in the analysis shall be per the OSSC and the standards referenced therein.
 - 2. Limiting deflection(s)/ displacement(s) used in the analysis shall be those maximum deflections that will not preclude the component from meeting its seismic performance requirement.
 - a. Use of deflection/ displacement limits either provided by the component manufacturer or determined from supporting tests is acceptable.
- E. Acceptability is based on the applicable demands (e.g., resultant stresses, deflections, etc.) not exceeding the associated capacities.
 - 1. Any deviation from this requirement shall be justified in terms of the component achieving its seismic performance requirement.
- F. If the component being qualified will be connected to other components, the qualification shall provide the permissible forces (e.g., nozzle loads, etc.) and, as applicable, anticipated displacements of the component at the connection points to facilitate assessment for consequential damage, in accordance with ASCE 7 paragraph 13.2.3.
- G. Components meeting the shake table and/or seismic testing requirements of the following and seismic requirements are considered to meet the Special Seismic Certification requirements for the project:
 - 1. ANSI/AHRI Standard 1270
 - 2. IEEE Standard 344
 - 3. IEEE Standard 693
 - 4. ASME QME-1

3.5 SUPPORTING ANALYSIS (FOR USE WITH QUALIFICATION BY TESTING)

- A. Supporting analysis/ analytical calculations may be used to develop data for use in qualification testing.
- B. The results of qualification testing may be used in supporting analysis/ analytical calculations to complete the qualification of the component.

- C. Supporting analysis/ analytical calculations shall comply with all portions of the aforementioned Section "QUALIFICATION BY ANALYSIS", as applicable.

3.6 SUPPORTING TESTS (FOR USE WITH QUALIFICATION BY ANALYSIS)

- A. Supporting tests may be either static or dynamic in nature; however, static tests are not applicable to the active parts, or the energized subcomponents, of active components.
- B. Static supporting tests are conducted by applying static forces on the equipment. Typical data obtained from these tests are as follows:
 - 1. Static deflections and flexibility parameters that are needed for constructing a mathematical model.
 - 2. Distortion in the equipment casing, due to nozzle loads, and the deformation limits within which the equipment would maintain its operability/ functionality.
- C. Dynamic supporting tests shall be conducted using a shake table. Typical data obtained from dynamic supporting tests are as follows:
 - 1. Dynamic characteristics of the equipment (natural frequencies, mode shapes and damping factors).
 - 2. Cross-coupling effects, i.e., the response in any direction due to the excitation in any other direction (in situations where installing accelerometers in some locations is impractical, cross-coupling may be estimated based on the response of the available accelerometer locations).
 - 3. The significance of the response of the equipment to vibratory motion to determine the necessity of combining equipment nozzle loads with other dynamic loads.

3.7 LOADS ON SUPPORTING STRUCTURE

- A. All loads transmitted by the component to the supporting structure shall be provided. The following loads, as applicable, shall be reported individually, and included in the determination of the transmitted loads:
 - 1. Dead load/ operating weight.
 - 2. Operational/ service loads.
 - 3. Nozzle loads.
 - 4. Pressure and thermal loads.
 - 5. Additional loads due to seismic excitations.
 - 6. Any other loads that are required to be transmitted to the structure/ foundation during the design seismic event.

3.8 COORDINATION

- A. Do not fabricate or install seismic restraints or non-building structures until submittals have been approved.
- B. Verify that multiple systems installed in the same vicinity can be installed without conflict.
- C. Verify tolerances between installed items to confirm that unbraced components will not come into contact with restrained equipment or structural members during an earthquake. When contact is possible, provide seismic restraint or provide justification to Owner's satisfaction that contact will not cause unacceptable damage to the components in contact, their supports, finishes or other elements that are contacted.

3.9 DESIGN AND GENERAL CONSTRUCTION

- A. Attach or anchor components and their supports, non-building structures, and Designated Seismic Systems to the structure. Provide a continuous load path of sufficient strength and stiffness between the component and the supporting structure.
- B. Design equipment support and bracing to resist seismic design force in any direction.
- C. Provide supports, braces, connections, hardware, and anchoring devices to withstand code- required seismic forces and seismic deformations without shifting or overturning.
- D. For components with $I_p = 1.5$, in addition to providing for code-required seismic forces and deformations, construct installations capable of providing post-earthquake functionality.
- E. Bolt, weld, or otherwise positively fasten component attachments in accordance with ASCE 7 Chapter 13 without consideration of frictional resistance produced by the effects of gravity.
- F. Where equipment is mounted on vibration isolators and restraints, use isolators and restraints designed for amplified code forces per ASCE 7 and with demonstrated ability to resist required forces including gravity, operational, and seismic forces.
- G. As an alternate to project-specific design of seismic bracing, use of proprietary restraint systems with a Certificate of Compliance verified and listed by an accredited Inspection Agency is acceptable. Use of a certified product does not preclude the requirement for Shop Drawings.
- H. Design piping, piping risers, ducts, and duct risers to accommodate inter-story drift.

- I. Provide flexible connections:
 - 1. Between floor-mounted equipment and suspended piping.
 - 2. Between unbraced piping and restrained suspended items.
 - 3. As required for thermal movement.
 - 4. At building separations and seismic joints.
 - 5. Wherever relative differential movements could damage piping in an earthquake.
- J. Where piping is explicitly exempt from seismic bracing requirements, provide flexible connections between piping and connected equipment, including in-line devices such as VAV boxes and reheat coils.
- K. Where piping is explicitly exempt from seismic bracing requirements, install piping such that swinging of the pipes will not cause damaging impact with adjacent components, finishes or structural framing. This will be considered satisfied if there is horizontal clear distance of at least $\frac{4}{3}$ the hanger length between subject components. If swinging of exempted piping can cause damaging contact with adjacent components, finishes or structural framing, add swing restraints as required to eliminate contact.
- L. Ductwork:
 - 1. Provide independent support for in-line devices weighing more than 20 pounds.
 - 2. Provide independent support and bracing for in-line devices weighing more than 75 pounds.
- M. Provide unbraced piping attached to braced in-line equipment with adequate flexibility to accommodate differential displacements.
- N. Tanks:
 - 1. Design tank to resist seismic design forces.
 - 2. Design tank anchorage to resist seismic design forces.
 - 3. Design tank legs or supporting structure to resist seismic design forces.
 - 4. Provide flexible connections between tank and interconnected piping.
- O. Fire suppression equipment and piping:
 - 1. See requirements for piping.
 - 2. See requirements for equipment.
 - 3. Satisfy requirements of NFPA 13 and the force and displacement requirements of ASCE 7. All components shall be UL listed.

4. Provide end of line restraint as required by NFPA 13.
- P. Conduit, cable tray, bus duct, raceways, bundled cabling:
1. Where conduit tray or bus duct or raceway or bundled cabling, is explicitly exempt from seismic bracing requirements, install these such that swinging of the component(s) will not cause damaging impact with adjacent components, finishes or structural framing. This will be considered satisfied if there is horizontal clear distance of at least $\frac{4}{3}$ the hanger length between subject components. If swinging of exempted components can cause damaging contact with adjacent components, finishes or structural framing, add swing restraints as required to eliminate contact.
 2. Provide gravity support for conduit/cable tray/bus duct/raceway/bundled cabling that is independent of suspended ceiling framing.
 3. Provide seismic bracing of conduit/cable tray/bus duct/raceway/bundled cabling to resist gravity and seismic design forces.
 4. Design conduit/cable tray/bus duct/raceway/bundled cabling to accommodate interstory drift.
- Q. As an alternate to project-specific design of seismic bracing, use of proprietary restraint systems with a Certificate of Compliance verified and listed by an accredited Inspection Agency is acceptable. Use of a certified product does not preclude the requirement for Shop Drawings.
1. Provide flexible connections wherever relative differential movement could damage conduit/cable tray/bus duct/raceway/bundled cabling in an earthquake.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 SUMMARY:

A. Section Includes:

1. General requirements applicable to all electrical work
2. General requirements for electrical submittals.

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. Special subcontractor requirements:
 1. As specified elsewhere in this Section, provide the Work specified in the Electrical Specifications by a qualified electrical subcontractor.
- F. Contract Documents:
 1. General:
 - a. The Drawings and Specifications are complementary and are to be used together to fully describe the Work.
 2. Specifications:
 - a. The General and Supplementary Conditions of the Contract Documents govern the Work.
 - b. These requirements are in addition to all General Requirements.
 3. 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:

- 1) 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.

4. Not all typical installation details are referenced within the Drawing set. Apply and use typical details where appropriate.

a. Schematic Diagrams:

- 1) All controls are shown de-energized.
- 2) Schematic diagrams show control function only. Incorporate other necessary functions for proper operation and protection of the system.
- 3) Add slave relays, where required, to provide all necessary contacts for the control system or where needed to function as interposing relays for control voltage coordination, equipment coordination, or control system voltage drop considerations.
- 4) Control schematics are to be used as a guide in conjunction with the descriptive operating sequences found in the Specifications. Combine all information and furnish a coordinated and fully functional control system.

- G. The Contractor shall coordinate with the local electric Utility for the installation of the electrical service at the Owner's facility.

H. Alternates/Alternatives:

1. Refer to the General Conditions for substitute item provisions.
- I. Changes and Change Orders:
 1. Refer to the General Conditions.

1.2 REFERENCES

A. Code Compliance:

1. As specified in Section 01 10 00, Summary of Work.
2. The publications are referred to in the text by the basic designation only. The latest edition accepted by the Authority Having Jurisdiction of referenced publications in effect at the time of the bid governs.
3. The standards listed are hereby incorporated into these Specifications:
 - a. National Electrical Code (NFPA No 70).
 - b. Institute of Electrical and Electronic Engineers (IEEE).
 - c. National Electrical Manufacturers Association (NEMA).
 - d. National Fire Protection Association (NFPA).
 - e. Underwriters' Laboratories, Inc. (UL).
 - f. Insulated Power Cable Engineers Association (IPCEA).
 - g. American National Standards Institute (ANSI).
 - h. American Society of Testing Materials (ASTM).
 - i. National Bureau of Standards.
 - j. Institute of Power Cable Engineers Association National Board of Fire Underwriters (NBFU).
 - k. Illuminating Engineering Society (IES) of North America.
 - l. Safety Orders of Industrial Accident Commission.
 - m. Rules of the National Board of Fire Underwriters.
 - n. Requirements of the serving Utilities.

4. All electrical equipment and devices provided in this project shall be UL listed and meet UL requirements.
- B. Compliance with Laws and Regulations:
1. Refer to the General Conditions.
 2. Installation of electrical equipment and materials shall comply with OSHA Safety and Health Standards (29 CFR 1910 and 29CFR 1926, as applicable); state building standards, and applicable local codes and regulations.
 3. Where the requirements of the specifications conflict with UL, NEMA, NFPA, or other applicable standards, the more stringent requirements shall govern. Code compliance is mandatory. Work shall be in complete accordance with applicable codes.

1.3 DEFINITIONS

- A. Definitions of terms and other electrical and instrumentation considerations as set forth in the:
1. NEC - National Electrical Code.
 2. IEEE - Institute of Electrical and Electronic Engineers.
 3. Instrumentation Systems and Automation Society.
 4. NFPA - National Fire Protection Association.
 5. NETA - National Electrical Testing Association.
- B. Specific Definitions:
1. EPSS: Emergency Power System Supplier.
 2. FAT: Factory Acceptance Test.
 3. LCP: Local Control Panel: Operator interface panel that may contain an HMI, pilot type control devices, operator interface devices, control relays, etc. and does not contain a PLC or RIO.
 4. PCM: Process Control Module: An enclosure containing any of the following devices: PLC, RTU, or RIO.
 5. LCS: Local Control Station: Operator interface panel that may contain pilot type control devices, operator interface devices, etc.

6. PICS: Process Instrumentation and Control System.
7. ORT: Operational Readiness Test.
8. Space: That portion of the motor control center, panelboard, or control panel that does not physically contain a device but is capable of accepting a device, with no modifications to the equipment, i.e. provide all standoffs, bus, and hardware, as part of the space.
9. Spare: That portion of the motor control center, panelboard, or control panel that physically contains a device with no load connections as part of this project.
10. Unequipped Space: That portion of the motor control center, panelboard, or control panel that does not physically contain a device, standoff, bus, hardware, or other equipment.

1.4 SYSTEM DESCRIPTION

A. General Requirements:

1. The Work includes everything necessary for and incidental to executing and completing the electrical work described in the Drawings and Specifications and reasonably inferable there from:
 - a. The electrical Drawings are schematic in nature. Use the structural, architectural, mechanical, and civil drawings for all dimension and scaling purposes.
2. It is the intent of these Specifications that the entire electrical power, instrumentation, and control system be complete and operable. Provide all necessary material and labor for the complete system from source of power to final utilization equipment, including all: connections, testing, calibration of equipment furnished by others, as well as equipment furnished by the Contractor, whether or not specifically mentioned, but which are necessary for successful operation.
3. Provide all electrical work, including conduit, field wiring, and connections by the electrical Subcontractor under the provisions of Division 26 for all aspects of the Work, including heating, ventilation, and air conditioning.
4. Coordinate all aspects of the Work with the electrical Subcontractor and other Subcontractors before bidding in order to ensure that all costs associated with a complete installation are included. The Owner is not responsible for any change orders due to lack of coordination of the Work between the Contractor, the electrical Subcontractor, the other Subcontractors or Suppliers.
5. Demolition:

- a. Where demolition is specified or indicated on the Drawings, disconnect all associated electrical equipment and render the equipment safe.
 - b. Remove and dispose of all conduit, wire, electrical equipment, controls, etc. associated with the items and/or areas to be demolished as indicated on the Drawings unless otherwise indicated.
 - c. Salvage electrical equipment and return to client as indicated on the Drawings.
 - d. For each piece of equipment to be removed, remove all ancillary components (e.g. instruments, solenoid valves, disconnect switches, etc.).
 - e. Conduit:
 - 1) Where conduit removal, other than associated with equipment to be removed, is indicated on the Drawings:
 - a) Remove exposed conduit to the point of encasement or burial.
 - b) Cut conduit flush and plug or cap encased or buried conduit.
 - 2) Where conduits are to remain in place and removal is not indicated on the Drawings:
 - a) Cap conduit open ends.
 - b) Re-label empty conduits as spare.
 - f. Remove all wire back to the source for all conduits to be removed or abandoned in place.
 - g. Provide new nameplates for modified electrical distribution equipment, motor control centers etc. to identify equipment and circuits that are no longer used as spares.
 - h. Provide new typewritten schedules for all modified panelboards.
6. Where portions of the Project involve installation in existing facilities and interfaces to existing circuits, power systems, controls, and equipment:
- a. Perform and document comprehensive and detailed field investigations of existing conditions (circuits, power systems, controls, equipment, etc.) before starting any Work. Determine all information necessary to document, interface with, modify, upgrade, or replace existing circuits, power systems, controls, and equipment.

- b. Provide and document interface with, modifications to, upgrades, or replacement of existing circuits, power systems, controls, and equipment.
 - 7. Provide all trenching, forming, rebar, concrete, back filling, hard surface removal and replacement, for all items associated with the electrical work and installation.
 - a. As specified in the Contract Documents.
 - 8. Defective Work:
 - a. Refer to the General Conditions.
- B. Work in an Operating Facility:
 - 1. 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:
 - a. 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.
 - b. As weather and water demand conditions dictate, re-adjust the construction schedule to meet the demands placed upon Owner by its users.
 - c. Coordinate the construction and power renovation, bear all costs, so that all existing facilities can continue operation throughout construction.
 - 2. According to individual circumstances and in compliance with the Drawings, extend or replace conduit and cable connections from existing locations.
 - 3. 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.

1.5 SUBMITTALS

- A. Furnish submittals as specified in Section 01 33 00, Submittal Procedures and this Section.
- B. General:
 - 1. Instruct all equipment suppliers of submittals and operation and maintenance manuals of the requirements in this Section.

2. Furnish the submittals required by each section in the Electrical Specifications.
 3. Adhere to the wiring numbering scheme specified in Section 26 05 53, Identification for Electrical Systems throughout the Project:
 - a. Uniquely number each wire.
 - b. Show wire numbers on all Equipment Drawings.
 4. Use equipment and instrument tags, as indicated on the Drawings, for all submittals.
 5. Provide list of manufacturers recommended spare parts.
- C. Submittal organization:
1. First page:
 - a. Specification section reference.
 - b. Name and telephone number of individual who reviewed submittal before delivery to Engineer.
 - c. Name and telephone number of individual who is primarily responsible for the development of the submittal.
 - d. Place for Contractor's review stamp and comments.
 2. Next pages:
 - a. Provide confirmation of specification compliance in a tabular form that individually lists each specification section, paragraph, and sub-paragraphs and unequivocally states compliance with said requirement or takes exception to the requirement and lists the reason for said exception and offers alternative means for compliance.
 - b. Include a response in writing to each of the Engineer's comments or questions for submittal packages which are re-submitted:
 - 1) In the order that the comments or questions were presented throughout the submittal.
 - 2) Referenced by index section and page number on which the comment appeared.
 - 3) Acceptable responses to Engineer's comments are either:

- a) Engineer's comment or change is accepted, and appropriate changes are made.
 - b) Explain why comment is not accepted or requested change is not made.
 - c) Explain how requirement will be satisfied in lieu of comment or change requested by Engineer.
 - 4) Any re-submittal, which does not contain responses to the Engineer's previous comments shall be returned for Revision and Re-submittal.
 - 5) No further review by the Engineer will be performed until a response for previous comments has been received.
3. Remaining pages:
- a. Actual submittal data:
 - 1) Organize submittals in exactly the same order as the items are referenced, listed, and/or organized in the specification section. For submittals that cover multiple devices used in different areas under the same specification section, the submittal for the individual devices must list the area where the device is intended to be used.

D. Submittal requirements:

- 1. Furnish submittals that are fully indexed with a tabbed divider for every component.
- 2. Sequentially number pages within the tabbed sections. Submittals and operation and maintenance manuals that are not fully indexed and tabbed with sequentially numbered pages, or are otherwise unacceptable, will be returned without review.
- 3. Edit all submittals and operation and maintenance manuals so that the submittal specifically applies to only the equipment furnished.
 - a. Neatly cross out all extraneous text, options, models, etc. that do not apply to the equipment being furnished, so that the information remaining is only applicable to the equipment being furnished.
- 4. Submit copies of shop drawings, and product data:
 - a. Show dimensions, construction details, wiring diagrams, controls, manufacturers, catalog numbers, and all other pertinent details.

5. Where submittals are required, provide a separate submittal for each specification section. In order to expedite construction, the Contractor may make more than 1 submittal per specification section, but a single submittal may not cover more than 1 specification section:
 - a. The only exception to this requirement is when 1 specification section covers the requirements for a component of equipment specified in another section. (For example, circuit breakers are a component of switchgear. The switchgear submittal must also contain data for the associated circuit breakers, even though they are covered in a different specification section.)
6. Exceptions to Specifications and Drawings:
 - a. Include a list of proposed exceptions to the Specifications and Drawings along with a detailed explanation of each.
 - b. If there is insufficient explanation for the exception or deviation, the submittal will be returned requiring revision and re-submittal.
 - c. Acceptance of any exception is at the sole discretion of the Engineer.
 - 1) Provide all items (materials, features, functions, performance, etc.) required by the Contract Documents that are not accepted as exceptions.
 - d. Replace all items that do not meet the requirements of the Contract Documents, which were not previously accepted as exceptions, even if the submittals contained information indicating the failure to meet the requirements.
7. Specific submittal requirements:
 - a. Shop drawings:
 - 1) Required for materials and equipment listed in this and other sections.
 - 2) Furnish sufficient information to evaluate the suitability of the proposed material or equipment for the intended use, and for compliance with these Specifications.
 - 3) Shop drawings requirements:
 - a) Front, side, and, rear elevations, and top and bottom views, showing all dimensions.
 - b) Locations of conduit entrances and access plates.

- c) Component layout and identification.
- d) Schematic and wiring diagrams with wire numbers and terminal identification.
- e) Connection diagrams, terminal diagrams, internal wiring diagrams, conductor size, etc.
- f) Anchoring method and leveling criteria, including manufacturer's recommendations for the Project site seismic criteria.
- g) Weight.
- h) Finish.
- i) Nameplates:
 - (1) As specified in Section 26 05 53, Identification for Electrical Systems.
- j) Temperature limitations, as applicable.

b. Product data:

- 1) Submitted for non-custom manufactured material listed in this and other sections and shown on shopdrawings.
- 2) Include:
 - a) Catalog cuts.
 - b) Bulletins.
 - c) Brochures.
 - d) Quality photocopies of applicable pages from these documents.
 - e) Identify on the data sheets the Project name, applicable specification section, and paragraph.
 - f) Identify model number and options for the actual equipment being furnished.
 - g) Neatly cross out options that do not apply or equipment not intended to be supplied.

c. Detailed sequence of operation for all equipment or systems.

E. Operation and Maintenance Manuals:

1. Furnish the Engineer with a complete set of written Operation and Maintenance Manuals eight (8) weeks before energization start-up and/or commissioning.
2. Furnish in accordance Section 01 33 00, Submittal Procedures and the following additional requirements:
 - a. Completely index manuals with a tab for each section:
 - 1) Each section containing applicable data for each piece of equipment, system, or topic covered.
 - 2) Assemble manuals using the approved shop drawings, and include, the following types of data:
 - a) Complete set of 11-inch by 17-inch drawings of equipment.
 - b) Complete set of 11-inch by 17-inch drawings of the control system.
 - c) Complete set of control schematics.
 - d) Complete parts list for all equipment being provided.
 - e) Catalog data for all products or equipment furnished.

F. Material and Equipment Schedules:

1. Furnish a complete schedule of all materials, equipment, apparatus, and luminaries that are proposed for use:
 - a. Include sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.

G. Roof Penetrations:

1. 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.
2. 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.

H. Installation Recommendations:

1. Submit the manufacturer's printed recommendations for installation of electrical equipment.
- I. Record Documents:
 1. Provide Record Documents of all electrical Drawings.
 2. Record Drawing requirements:
 - a. The Contractor shall show invert and top elevation and routing of all ductbanks and concealed below-grade electrical installations. Record drawings shall be prepared and be available to Engineer.
 - b. Update Record Drawings weekly.
 - c. Record Drawings shall be fully updated, as a condition of the monthly progress payments.
 - d. Submit Record Drawings upon completion of the Work for final review.
 - e. Record drawings shall be submitted seven (7) calendar days after all equipment has successfully completed ORT-1, ORT-2, and Performance test.
 - f. Clearly and neatly show all changes in accordance with the following:
 - 1) All existing pipe, conduit, wire, instruments, or other structures encountered or uncovered during construction.
 3. Shop Drawings:
 - a. Upon completion of the Work, update all shop drawings to indicate the final as-built configuration of the systems:
 - 1) Provide as-built Shop Drawings for all electrical equipment on 11 inch by 17-inch using Bond paper.
 - b. Furnish written information prepared specifically for this project using Microsoft Word 2010 or newer and PDF and printed on 8.5-inch by 11-inch plain bond paper:
 - 1) Provide electronic copies of these documents on flash drives.
 4. Review and Corrections:
 - a. Correct any Record Documents or other documents found to be incomplete, not accurate, of poor quality, or containing errors.

b. Promptly correct and re-submit Record Documents returned for correction.

J. Test Reports:

1. As specified in Section 01 33 00, Submittal Procedures.
2. Include the following:
 - a. A description of the test.
 - b. List of equipment used.
 - c. Name of the person conducting the test.
 - d. Date and time the test was conducted.
 - e. All raw data collected.
 - f. Calculated results.
 - g. Each report signed by the person responsible for the test.
3. Additional requirements for acceptance test reports are listed in Section 26 08 10 Electrical System Testing and Settings.

K. Calculations:

1. Where required by specific Division 26 Specifications:
 - a. Because these calculations are being provided by a Registered Professional Engineer, they will be reviewed for form, format, and content but will not be reviewed for accuracy and calculation means.

L. Factory Test:

1. As specified in Sections 01 33 00 Submittal Procedures and 01 75 16 Testing, Training and System Start Up.
2. Include complete test procedure and all forms to be used during test.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Perform all electrical Work in accordance with all codes and standards required by Division 26.

- B. Furnish all equipment listed by and bearing the label of Underwriters' Laboratories, Incorporated (UL) or of an independent testing laboratory acceptable to the Authority Having Jurisdiction.
- C. Factory Tests:
 - 1. Where specified in the individual product specification sections, factory tests shall be performed at the place of fabrication on completion of manufacture or assembly. The costs of factory tests shall be included in the contract price.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Contractor shall fully protect materials and equipment against damage from any cause until final acceptance.
- B. Delivery and Inspection:
 - 1. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include date of manufacture on label.
 - 2. Unload products in accordance with manufacturer's instructions for unloading, or as specified. Record the receipt of products at the site. Inspect for completeness and evidence of damage during shipment.
 - 3. Remove damaged products from the site and expedite delivery of identical new undamaged products. Augment incomplete shipments and replace lost products in order not to delay the progress of the Work.
- C. Special Instructions:
 - 1. Securely attach special instructions for proper field handling, storage, and installation to each piece of equipment before packaging and shipment.
- D. Storage and Protection:
 - 1. Provide for the safe storage and delivery of materials, whether furnished by the Contractor or by others.
 - 2. Meet all storage requirements of the manufacturer and provide for the safe storage of all materials and equipment, as recommended by the manufacturer.
 - 3. Protect electrical work at all times from damage, defacement, or deterioration from any cause whatever:
 - a. Provide proper storage facilities and conduct operations to this effect.

1.8 PROJECT OR SITE CONDITIONS

A. Site Conditions:

1. Provide electrical, instrumentation and control system, including all equipment, raceways and other components required for a complete installation that meets the environmental conditions for the site, as specified in the General Requirements and below.
2. Seismic Classification:
 - a. Provide all electrical equipment and construction techniques suitable for the seismic requirements for the site, as specified in the drawings.
3. Wind:
 - a. Provide all electrical equipment and construction techniques suitable for the site wind loading criteria, as specified in the drawings.
4. Altitude, Temperature and Humidity:
 - a. Provide electrical components and equipment that are fully rated for continuous operation at this altitude.
 - b. Provide additional temperature conditioning equipment to maintain all equipment in non-conditioned spaces subject to these ambient temperatures, with a band of 10 degrees Fahrenheit above the minimum operating temperature and 10 degrees Fahrenheit below maximum operating temperature, as determined by the equipment manufacturer's guidelines:
 - 1) Provide all power conduit and wiring for these devices whether shown on the Drawings or not.
5. Outdoor Installations:
 - a. Provide electrical, instrumentation and control equipment suitable for operation in the ambient conditions where the equipment is located.
 - b. Provide heating, cooling, and de-humidifying devices incorporated into and included with electrical equipment, instrumentation and control panels to maintain the enclosures within the rated environmental operating ranges, as specified in this Section for the equipment:
 - 1) Provide all wiring necessary to power these devices.

- B. Provide enclosures for electrical, instrumentation and controls equipment, regardless of Supplier or Subcontractor furnishing the equipment, that meet the requirements outlined in NEMA Standard 250 for the types of enclosures defined below:
1. NEMA 1 Enclosures: Intended for indoor use, primarily to provide a degree of protection from accidental contact with energized parts or equipment.
 2. NEMA 4 Enclosures: Intended for indoor or outdoor use, primarily to protect equipment from exposure to windblown dust and rain, splashing or hose directed water, ice formation, and freezing.
 3. NEMA 4X Enclosures: Made from corrosion resistant materials (Fiberglass reinforced plastic, 316 Stainless Steel, or equal) and intended for indoor or outdoor use, primarily to protect equipment from exposure to windblown dust and rain, splashing or hose directed water, ice formation, freezing, or corrosion.
 4. NEMA 12 Enclosures: Intended for indoor use, primarily to provide a degree of protection from dust, falling dirt, or dripping non-corrosive liquids.
 5. NEMA 7 Enclosures: Designed to contain an internal explosion without causing an external hazard. Indoor use in hazardous (Classified) locations classified as Class I, Division 1, Groups A, B, C, or D as defined in NFPA 70.
 6. NEMA 8 Enclosures: Designed to prevent combustion through the use of oil-immersed equipment. Indoor or outdoor use in hazardous (Classified) locations classified as Class I, Division 1, Groups A, B, C and D as defined in NFPA 70.

1.9 SCHEDULING

A. General:

1. Testing requirements are specified in Section 26 08 10 Electrical System Testing and Settings and other Sections.
2. General scheduling requirements are specified in Section 01 33 00 Submittal Procedures.

B. Pre-Submittal Conference:

1. Before producing any submittals, schedule a pre-submittal conference for the purposes of reviewing the entire project, equipment, control philosophy, schedules, and submittal requirements.
2. The Contractor, instrumentation and control Subcontractor, electrical Subcontractor, all Suppliers, and individual equipment manufacturers furnishing major pieces of equipment shall attend, including but not limited to:

- a. Control Panels
 - b. Vendor Control Panels.
 - c. Motor Control Centers.
 - d. Switchgear.
 - e. Variable Frequency Drives.
 - f. Lighting.
- C. Factory Acceptance Testing:
- 1. Where factory acceptance testing is required for equipment covered by these Specifications or individual product specification sections, notify the Engineer in writing when the equipment is completed and ready for factory inspection and testing:
 - a. Indicate the desired dates for inspection and testing.
 - b. Schedule the FAT after approval of the FAT procedures submittal:
 - 1) Submit a copy of the test procedures, including all forms at least 21 days before any scheduled test date.
 - 2) Notify the Engineer of the scheduled tests a minimum of 15 days before the date of the test.
 - 2. Refer to individual Division 26 sections for additional FAT requirements.

1.10 WARRANTY

- A. Warrant the electrical work in accordance with the General Conditions.
 - 1. Provide additional warranty as specified by the individual Division 26 sections.

1.11 SYSTEM STARTUP

- A. Replace or modify equipment, software, and materials that do not achieve design requirements after installation, in order to attain compliance with the design requirements:
 - 1. Following replacement or modification, retest the system and perform additional testing to place the complete system in satisfactory operation and obtain compliance acceptance from the Engineer.

1.12 MAINTENANCE

- A. Before Substantial Completion, perform all maintenance activities required by the Specifications, including calibrations, final adjustments, component replacements, or other routine service required, before placing equipment or systems in service.
- B. Furnish all spare parts as required by the Specifications.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide similar items of same manufacturer throughout the electrical and instrumentation portion of the project.
- B. Allowable manufacturers are specified in Division 26.

2.2 MATERIALS

- A. Furnish all materials under this Contract that are new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these products and that bear all approvals and labels, as required by the Specifications.
- B. Provide materials complying with the applicable industrial standard in accordance with the General Conditions.
- C. Stainless Steel:
 - 1. Where stainless steel is indicated or used for any portion of the electrical work, provide a non-magnetic, corrosion-resistant alloy, ANSI Type 316, satin finish, as specified.
 - 2. Provide exposed screws of the same alloys.
 - 3. Provide finished material free of any burrs or sharp edges.
 - 4. Use only stainless-steel hardware, when chemically compatible, in all areas that are or could be in contact with corrosive chemicals.
 - 5. Use stainless steel hardware, when chemically compatible, in all chemical areas or areas requiring NEMA 4X construction.
 - 6. Do not use stainless steel in any area containing chlorine gas or solution, chlorine products, or ferric chloride.

2.3 SOURCE QUALITY CONTROL

- A. Provide all equipment that is new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these products.
- B. Arrange with all manufacturers of the electrical equipment, to allow the Owner and Engineer to inspect and witness the testing of the equipment at the site of fabrication:
 - 1. Testing includes the cabinets, special control systems, power equipment, and other pertinent systems and devices.
- C. Factory testing is specified in other sections of Divisions 26.

PART 3 EXECUTION

3.1 EXAMINATION

- A. The electrical contractor or subcontractor is required to examine the premises completely before bidding. It is the electrical contractor or subcontractor's responsibility to be fully familiar with the existing conditions and local requirements and regulations.
- B. Review the existing site conditions and examine all Shop Drawings in order to determine exact routing and final terminations for all wiring and cables.
- C. Provide a complete electrical system.
 - 1. Install all extra conduits, cables, and interfaces, as needed to provide a complete and operating electrical, PICS, and HVAC system.

3.2 INSTALLATION

- A. Equipment locations shown on electrical Drawings may change due to variations in equipment size or minor changes made by others during construction:
 - 1. Verify all dimensions indicated on the Drawings:
 - a. Actual field conditions govern all final installed locations, distances, and levels.
 - 2. Review all Contract Documents and approved equipment shop drawings and coordinate Work as necessary to adjust to all conditions that arise due to such changes.
 - 3. Make minor changes in location of equipment before rough in, as directed by the Owner or Engineer.

4. Provide a complete electrical system:
 - a. Install all extra conduits, cables, and interfaces as may be necessary to provide a complete and operating electrical system.
- B. Install all material and equipment in accordance with the manufacturer's installation instructions:
 1. Where Contractor asks to deviate from the manufacturer's recommendations, such changes must be reviewed and accepted by the Engineer and manufacturer before installation.
- C. Cutting and Patching:
 1. Perform all cutting, patching, channeling, core drilling, and fitting required for the electrical Work, except as otherwise directed:
 - a. Secure the permission of the Engineer before performing any operation likely to affect the strength of a structural member:
 - 1) Before cutting, channeling, or core drilling any surface, ensure that no penetration of any other systems will be made:
 - a) Verify that area is clear and free of conduits, cables, piping, ductwork, or post-tensioning cables.
 - b) Use tone-locate system or X-ray to ensure that area is clear of obstructions.
 - b. Review the complete Drawing set to ensure that there are no conflicts or coordination problems before cutting, channeling, or core drilling any surface.
 2. Perform all patching to the same quality and appearance as the original Work. Employ the proper tradesmen to secure the desired results. Seal around all conduits, wires, and cables penetrating walls, ceilings, and floors in all locations, with a fire stop material, typically:
 - a. 3M CP25WB+ Caulk
 - b. 3M Fire Barrier Putty
 3. Seal around conduit penetrations of below grade walls, with a waterproof, non-shrink, non-metallic grout, unless otherwise indicated on the typical installation details:

- D. Use the installation details provided in the Drawings as a guide for acceptable sealing methods.
- E. Install all conduit and equipment to avoid all obstructions and to preserve headroom and keep openings and passageways clear:
 - 1. Install all conduits and equipment in accordance with working space requirements as outlined in Article 110, Requirements for Electrical Installations of the National Electrical Code.
 - 2. Where the Drawings do not show dimensions for locating equipment, install equipment in approximate locations shown on the Drawings. Adjust locations shown on the Drawings to avoid any obstruction or interferences.
 - 3. Where an obstruction interferes with equipment operation or safe access, relocate the equipment.
 - 4. Where the Drawings do not indicate the exact mounting and/or supporting method to be used, use materials and methods similar to the mounting details shown in the Drawings.
- F. Earthwork and Concrete:
 - 1. Install all trenching, shoring, concrete, backfilling, grading, and resurfacing associated with the electrical Work:
 - a. Requirements as specified in the Contract Documents.
- G. Roof Penetrations:
 - 1. Seal conduit penetrations in accordance with roofing manufacturer's instructions.
- H. Terminations:
 - 1. Provide and terminate all conductors required to interconnect power, controls, instruments, panels, and all other equipment.
- I. Miscellaneous Installation Requirements:
 - 1. In case of interference between electrical equipment shown on the Drawings with other equipment, refer to the General Conditions for direction.
 - 2. Location of manholes and pullboxes shown on Drawings are approximate. Coordinate exact location of manholes and pullboxes with mechanical and civil Work.
 - 3. Provide additional manholes or pullboxes required to make a workable installation.

- 4. Circuits of different service voltage:
 - a. Voltage and service levels:
 - 1) Medium Voltage: Greater than 1.0kV.
 - 2) Low Voltage: 120V to 600V.
 - 3) Instrumentation: Less than 50VDC.
 - b. Install instrumentation and power circuits in separate raceways, junction boxes, manholes, hand holes, and pullboxes.
 - c. In manholes, install all cables operating at less than 50 VDC in PVC coated flexible metallic conduit, with corrosion resistant fittings.
- J. Labeling:
 - 1. Provide all nameplates and labels as required in specification Section 26 05 53 Identification for Electrical Systems.
- K. Equipment Tie-Downs:
 - 1. Concrete housekeeping pads shall be provided for indoor floor standing electrical equipment. Housekeeping pads for the equipment, including future units, shall be 3-1/2 inches above surrounding finished floor and 3 inches larger than equipment in all directions, unless otherwise indicated.
 - 2. Anchor all instruments, control panels, and equipment by methods that comply with the site seismic and wind bracing requirements.
 - 3. All control panels, Local Control Stations (LCSs), Local Control Panels (LCPs), Remote Terminal Units (RTUs), and Programmable Logic Controllers (PLCs) shall be permanently mounted and tied down to structures, in accordance with Section 26 05 29 Hangers and Supports for Electrical Systems.

3.3 TESTING AND FACILITY STARTUP

- A. As specified in Section 01 75 16, Testing, Training and System Start-Up.
- B. For Owner and Engineer witnessed FAT:
 - 1. The Contractor is responsible for the Owner's and Engineer's costs associated with FAT as specified in individual equipment Sections.
- C. Owner Training:

1. As specified in individual equipment Sections or Section 01 75 16.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Allow for inspection of electrical system installation.
2. Provide any assistance necessary to support inspection activities.
3. Engineer inspections may include, but are not limited to, the following:
 - a. Inspect equipment and materials for physical damage.
 - b. Inspect installation for compliance with Drawings and Specifications.
 - c. Inspect installation for obstructions and adequate clearances around equipment.
 - d. Inspect equipment installation for proper leveling, alignment, anchorage, and assembly.
 - e. Inspect equipment nameplate data to verify compliance with design requirements.
 - f. Inspect raceway installation for quality workmanship and adequate support.
 - g. Inspect cable terminations.
 - h. Schedule Structural Engineer to inspect all mounting of electrical devices and all penetration and connections to structures.
4. Inspection activities conducted during construction do not satisfy inspection or testing requirements outlined in Section 26 08 10.

B. Field Acceptance Testing:

1. Notify the Engineer when the electrical Work is ready for field acceptance testing.
2. Perform the acceptance tests in accordance with Section 26 08 10 Electrical System Testing and Settings.
3. Record results of the required tests along with the date of test:
 - a. Use conduit identification numbers to indicate portion of circuit tested.

C. Workmanship:

1. Leave wiring in panels, manholes, boxes, and other locations neat, clean, and organized:
 - a. Neatly coil and label spare wiring lengths.
 - b. Shorten, re-terminate, and re-label in use and spare wire and cable, as directed by the Engineer or Owner.

3.5 CLEANING

A. General Requirements:

1. Remove all foreign material and restore all damaged finishes to the satisfaction of the Engineer and Owner.

B. Clean and vacuum all enclosures to remove all metal filings, surplus insulation, visible dirt, dust, or other matter before energization of the equipment or system start up:

1. Use of compressors or air blowers for cleaning is not acceptable.
2. Prior to energization of equipment, provide a letter from manufacturer indicating that the equipment has been properly installed and cleaned, and get Engineer's approval.

C. Clean and re-lamp all luminaires that were used in the areas affected by the construction and return all used lamps to the Owner.

D. As specified in other Sections of the Contract Documents.

3.6 DEMONSTRATION AND TRAINING

A. Furnish all personnel and equipment necessary to conduct the demonstration and training requirements as specified in the individual sections.

3.7 PROTECTION

A. Protect all work from damage, dirt, dust, metal filings, condensation, or degradation until substantial completion of work.

B. Maintain all surfaces to be painted in a clean and smooth condition.

END OF SECTION

SECTION 26 08 10

ELECTRICAL SYSTEM TESTING AND SETTINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes requirements for:
 - 1. Responsibilities for testing the electrical installation.
 - 2. Routine tests during installation.
 - 3. Adjusting and calibration.
 - 4. Acceptance tests.
 - 5. Demonstration of electrical equipment.
 - 6. Facility startup.
- 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. Copyright information:
 - 1. Some portions of this section are copyrighted by the InterNational Electrical Testing Association, Inc (NETA). See NETA publication Acceptance Testing Specifications (ATS) for Electrical Power Equipment and Systems for details.

1.2 REFERENCES

- A. Refer to Section 26 05 00.
- B. American National Standards Institute (ANSI).
- C. ASTM International (ASTM):
 - 1. D 877 - Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.

2. D 923 - Standard Practices for Sampling Electrical Insulating Liquids.
 3. D 971 - Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method.
 4. D 974 - Standard Test Method for Acid and Base Number by Color-Indicator Titration.
 5. D 1298 - Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
 6. D 1500 - Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale).
 7. D 1524 - Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field.
 8. D 1816 - Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes.
 9. D 2285 - Standard Test Method for Interfacial Tension of Electrical Insulating Oils of Petroleum Origin Against Water by the Drop Weight Method.
 10. D 3612 - Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography.
- D. Institute of Electrical and Electronics Engineers(IEEE):
1. 43 - IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery.
 2. 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.
 3. 95 - IEEE Recommended Practice for Insulation Testing of AC Electric Machinery (2300 V and Above) With High Direct Voltage.
 4. 421.3 - IEEE Standard for High-Potential Test Requirement for Excitation Systems for Synchronous Machines.
 5. 450 - IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
 6. 1106 - IEEE Recommended Practice for Installation, Maintenance, Testing, and Replacement of Vented Nickel- Cadmium Batteries for Stationary Applications.

7. 1188 - IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.
 8. C57.13 - IEEE Standard Requirements for Instrument Transformers.
 9. C57.13.1 – IEEE Guide for Field Testing of Relaying Current Transformers
 10. C57.13.3 - IEEE Guide for Grounding of Instrument Transformer Secondary Circuits and Cases.
 11. C57.104 - IEEE Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers.
- E. Insulated Cable Engineer’s Association (ICEA).
 - F. InterNational Electrical Testing Association (NETA).
 1. ATS latest edition Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
 - G. International Electrotechnical Commission (IEC).
 - H. Manufacturer’s testing recommendations and instruction manuals.
 - I. National Fire Protection Association (NFPA):
 1. 70 – National Electrical Code (NEC).
 2. 110 - Standard for Emergency and Standby Power Systems.
 - J. National Institute of Standards and Technology (NIST).
 - K. Specification sections for the electrical equipment being tested.
 - L. Shop drawings

1.3 DEFINITIONS

- A. Refer to Section 26 05 00.
- B. Definitions of terms and other electrical considerations as set forth in the:
 1. National Electrical Testing Association.
- C. Specific definitions:
 1. Testing Laboratory: The organization performing acceptance tests.

1.4 SYSTEM DESCRIPTION

- A. Testing of all electrical equipment installed under this contract in accordance with the manufacturer's requirements and as specified in this Section.
- B. Conduct all tests in the presence of the Engineer or the Engineer's representative:
 - 1. The Engineer shall witness all visual, mechanical and electrical tests and inspections.
 - 2. Contact the Engineer and owner 10 days prior to the testing to allow witnessing of all tests.
- C. The testing and inspections shall verify that the equipment is operational within the tolerances required and expected by the manufacturer and these specifications. The results of the tests shall determine the suitability for continued reliable operation.
- D. Responsibilities:
 - 1. Contractor responsibilities:
 - a. Ensure that all resources are made available for testing, and that all testing requirements are met.
 - 2. Electrical Subcontractor responsibilities:
 - a. Perform routine tests during installation.
 - b. Demonstrate operation of electrical equipment.
 - c. Commission the electrical installation.
 - d. Provide the necessary services during testing, and provide these services to the testing laboratory, Contractor, and other subcontractors, including but not limited to:
 - 1) Providing electrical power as required.
 - 2) Operating of electrical equipment in conjunction with testing of other equipment.
 - 3) Activating and shutting down electrical circuits.
 - 4) Making and recording electrical measurements.
 - 5) Replacing blown fuses.

- 6) Installing temporary jumpers.
- 3. Testing laboratory responsibilities:
 - a. Perform all acceptance tests specified in this Section.
 - b. Provide all required equipment, materials, labor, and technical support during acceptance tests.
- E. Upon completion of testing or calibration, attach a label to all serviced devices:
 - 1. The label shall indicate the date serviced and the company that performed the service.

1.5 SUBMITTALS

- A. Furnish submittals in accordance with Sections 01 33 00 and 26 05 00.
- B. Manufacturers' testing procedures:
 - 1. Submit manufacturers' recommended testing procedures and acceptable test results for review by the Engineer.
- C. Test Report:
 - 1. Include the following:
 - a. Summary of project.
 - b. Description of equipment tested.
 - c. Description of tests performed.
 - d. Test results.
 - e. Conclusions and recommendations.
 - f. Completed test forms.
 - g. List of test equipment used and calibration dates.
- D. Testing Laboratory qualifications:
 - 1. Submit a complete resume and statement of qualifications from the proposed testing laboratory detailing their experiences in performing the tests specified:
- E. Division of responsibilities:

1. Submit a list identifying who is responsible for performing each portion of the testing.
- F. Manufacturers testing procedures:
1. Submit manufacturers recommended testing procedures and acceptable test results for review by the Engineer.

1.6 QUALITY ASSURANCE

- A. Refer to Section 26 05 00.
- B. Perform work to meet the requirements of legally constituted authorities having jurisdiction. Comply with the latest editions, amendments, practices, and rulings of the following documents and organizations, except where these specifications are more stringent:
1. National Electrical Code (NFPA No. 70).
 2. Emergency and Standby Power systems (NFPA 110).
 3. Institute of Electrical and Electronic Engineers.
 4. National Electrical Manufacturers Association.
 5. Insulated Power Cable Engineers Associations.
 6. American National Standards Institute.
 7. American Society of Testing Materials.
 8. Rules of the National Board of Fire Underwriters.
 9. Underwriters' Laboratories, Inc.
 10. National Electrical Testing Association - NETA.
 11. State and Local Codes and Ordinances.
 12. Association of Edison Illuminating Companies - AEIC.
 13. OSHA Part 1910; Subpart S, 1910.308.
 14. National Fire Protection Association - NFPA
- C. Testing Laboratory qualifications:

1. The Testing Laboratory may be qualified testing personnel from the electrical subcontractor's staff or an independent testing company.
2. Selection of the Testing Laboratory and testing personnel is subject to review by the Engineer based on testing experience and certifications of the individuals and testing capabilities of the organization.

1.7 PROJECT OR SITE CONDITIONS

- A. Refer to Section 26 05 00.

1.8 SEQUENCING

- A. At least 30 days before commencement of the acceptance tests, submit the manufacturer's complete field testing procedures to the Engineer and to the testing laboratory, complete with expected test results and tolerances for all equipment to be tested.
- B. Perform testing in the following sequence:
 1. Perform routine tests as the equipment is installed including:
 - a. Insulation resistance tests.
 - b. Continuity tests.
 - c. Rotational tests.
 2. Adjusting and preliminary calibration.
 3. Acceptance tests.
 4. Demonstration.
 5. Commissioning and plant startup.

1.9 WARRANTY

- A. Refer to Section 26 05 00.

1.10 FACILITY START UP

- A. Facility startup, as described in the Specifications, shall not begin until acceptance testing is complete, and operation has been demonstrated to the satisfaction of the Engineer.

- B. Facility start up shall only be attempted as a function of normal facility operation in which facility process flows and levels are routine and equipment operates automatically in response to flow and level parameters or computer command, as applicable:
 - 1. Simulation of process parameters shall be considered only upon receipt of a written request by the Contractor.
- C. Record all motor currents during normal operation.
- D. Record the indications of all power meters every half-hour during facility start up.

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 DATE

- A. The following information shall be provided:
 - 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 reports required in the latest edition of the ANSI/NETA Acceptance Testing Specifications (ATS).

PART 3 EXECUTION

3.1 TESTING

- A. GENERAL
 - 1. Testing shall be in accordance with the latest edition of the ANSI/NETA ATS.
 - 2. Equipment to be tested shall include but not limited to the following:
 - a. Switchgear.

- b. Dry Type Transformers.
 - c. Low voltage cables, 600 volts and less.
 - d. Low Voltage Molded Case and Insulated Case Circuit Breakers.
 - e. Instrument Transformers.
 - f. Metering Devices.
 - g. Grounding Systems.
 - h. Rotating Machinery.
 - i. Motor Starters, Low Voltage.
 - j. Motor Control Centers, Low Voltage.
 - k. Variable Frequency Drive Systems.
 - l. Surge Arrester, Low-Voltage.
 - m. Engine Generator.
 - n. Automatic Transfer Switch.
- B. Post-Installation Tests:
- 1. For all post-installation tests, the Contractor shall notify the Engineer 2 working weeks in advance.
- C. Test Reports:
- 1. The Contractor shall furnish the Engineer 3 copies of all test reports showing the results of all tests specified in this Section. Test forms shall clearly label the test type, the test location, test date, cable identification, and the result of the value of the tested parameter. Test reports shall state "PASS" or, "NOT PASSED."

3.2 ADJUSTING

- A. Adjust limit switches and level switches to their operating points before testing.
- B. Set pressure switches, flow switches, and timing relays to anticipated values before testing:
 - 1. Final settings shall be as dictated by operating results during testing.

3.3 CLEANING

- A. Refer to Section 26 05 00.
- B. Clean and vacuum enclosures to remove metal filings, surplus insulation, and visible dirt, dust, and other matter before starting system or energization of equipment.
- C. Do not use compressors or air blowers for cleaning.
- D. After the acceptance tests have been completed, all testing expendables shall be disposed of, all cabinets shall be vacuumed clean, and all surrounding areas shall be swept clean.

3.4 DEMONSTRATION AND TRAINING

- A. Refer to Section 26 05 00.
- B. Subsystem Demonstration:
 - 1. Subsystem, as used in this Section, means individual and groups of pumps, chemical feeders, air conditioning units, ventilation fans, lighting control systems, and other electrically operated or controlled equipment.
 - 2. Before demonstrating any subsystem:
 - a. Demonstrate proper operation of all alarm and status contacts.
 - b. Adjust and calibrate all process and control devices as accurately as possible.
 - 3. Operate each subsystem in its manual mode:
 - a. Demonstrate compliance with all Contract requirements.
 - 4. After each subsystem has operated successfully in its manual mode, perform automatic and remote operation demonstrations:
 - a. Verify that all features are fully operational and meet all Contract requirements.
 - b. Demonstrate all operating modes and sequences, including proper start and stop sequence of pumps, proper operation of valves and proper speed control.

END OF SECTION

SECTION 26 24 19

MOTOR CONTROL CENTERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes requirements for:
 - 1. Low voltage motor control centers.
- 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.

1.2 REFERENCES

- A. The Motor Control Center shall be manufactured and tested according to the latest applicable standards of the following agencies:
 - 1. UL 845 – Motor Control Centers
 - 2. NEMA ICS 18-2001 – Motor Control Centers
 - 3. NEMA ICS 1-2001 – Industrial Control and Systems: General Requirements
 - 4. NEMA ICS 2.3-2008 – Industrial Control and Systems: Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers

1.3 SYSTEM DESCRIPTION

- A. Factory assembled, factory wired and factory tested motor control centers:
 - 1. Motor control centers and major components to be products of a single manufacturer wherever possible. This includes but not limited to:
 - a. Service Entrance Rated Main Breaker
 - b. Starters.
 - c. Variable Frequency Drives (VFD).

- d. Panelboard.
- e. Circuit Breakers.
- f. Low Voltage Distribution Transformer.
- g. Power Quality Metering (PQM).
- h. Surge Protection Device (SPD).
- i. Related equipment specified in the Contract Documents or indicated on the Drawings.

1.4 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 and 26 05 00:

B. Product data:

1. Manufacturer of motor control center.
2. Manufacturer of motor control center parts.
3. Nameplate schedule.
4. Bill of material.
5. Enclosure:
 - a. NEMA rating.
 - b. Finish color.
6. Ratings:
 - a. Voltage.
 - b. Phase.
 - c. Current:
 - 1) Horizontal bus ampacity.
 - 2) Vertical bus ampacity.
 - 3) Ground bus ampacity.
 - d. Short circuit withstand rating.

- e. Protective device interrupting rating.
 - 7. List of manufacturer's recommended spare parts.
 - 8. Catalog cut sheets:
 - a. Submit complete manufacturer's catalog information:
 - 1) Clearly indicate the features of the equipment including any options necessary to meet the required functionality.
 - 9. Furnish circuit breaker submittals as specified in Section 26 28 16.13, Enclosed Circuit Breakers.
 - 10. Submit a letter confirming each variable frequency drive (VFD) unit contained within the MCC has been coordinated with its respective driven load. Letter shall list VFD location and driven equipment tag numbers as well as the FLA rating of each driven load motor. Motor data sheets for each driven load motor shall be attached to the coordination letter for verification.
 - 11. For equipment installed in structures designated as seismic design category C, D, E, or F submit the following:
 - a. Manufacturer's statement of seismic qualification with substantiating test data.
 - b. Manufacturer's special seismic certification with substantiating test data.
- C. Shop Drawings:
- 1. Layout drawings:
 - a. Provide fully dimensioned and to scale layout drawings which include:
 - 1) Dimensions:
 - a) Overall length.
 - b) Overall width.
 - c) Overall height.
 - d) Overall weight and weight of individual shipping splits.
 - 2. Indicate interfaces with other equipment on the drawings.
 - 3. Indicate shipping splits.

4. Identify allowable top and bottom conduit windows.
 5. Complete component and unit layout drawings.
 6. Indicate lug sizes, type, and manufacturer based on the cable size specified in the Contract Documents and as indicated on the Drawings.
 7. Elementary schematics:
 - a. Include all remote devices.
 - b. Indicate wire numbers for all wires on the diagrams:
 - 1) Wire numbering in accordance with Section 26 05 53.
 8. External connection diagram showing the wiring to the external controls and devices associated with the motor control center.
 9. One-line diagrams:
 - a. Provide complete one-line diagrams for each motor control center, including but not limited to: protective devices, starters, drives, metering, and other equipment.
 - b. Indicate electrical ratings of the equipment shown on the one-line diagrams.
- D. Installation instructions:
1. Detail the complete installation of the equipment including rigging, moving, and setting into place.
 2. For equipment installed in structures designated as seismic design category A or B:
 - a. Provide manufacturer's installation instructions and anchoring details for connecting equipment to supports and structures.
 3. For equipment installed in structures designated as seismic design category C, D, E, or F:
 - a. Provide project-specific installation instructions and anchoring details based on support conditions and requirements to resist seismic and wind loads.
 - b. Submit anchoring drawings with supporting calculations.
 - c. Drawings and calculations shall be stamped by a professional engineer registered in the state of Oregon.

E. Operation and Maintenance Manuals:

1. Submit complete operating and maintenance instructions presenting full details for care and maintenance of all types of equipment furnished or installed under this Section. Including but not limited to:
 - a. Electrical ratings:
 - 1) Phase.
 - 2) Wire.
 - 3) Voltage.
 - 4) Ampacity.
 - 5) Bus bracing and protective device interrupting ratings.
 - b. Complete Bill of Material.
 - c. Manufacturer's operating and maintenance instructions for the motor control center and all component parts, including:
 - 1) Starters.
 - 2) Overload relays and heater elements.
 - 3) Protective devices including, but not limited to, fuses, circuit breakers and protective relays.
 - 4) Pilot devices.
 - d. Complete renewal parts list.

F. Record Documents:

1. Elementary schematics:
 - a. Furnish as-built elementary schematics indicating final:
 - 1) Wire numbers.
 - 2) Interfaces with other equipment.
 - b. Provide one custom schematic diagram for each compartment:
 - 1) Include all remote devices.

- 2) Show wire numbers on the schematics.
- c. Layout drawings: Provide complete dimensioned component and unit layout drawings.
2. The Record Documents shall reflect all modifications made during the submittal review process and during construction.
- G. Calculations:
 1. Detailed calculations or details of the actual physical testing performed on the motor control center to prove the motor control center is suitable for the seismic requirements at the Project Site.

1.5 SPARE PARTS

- A. No spare parts are required.

1.6 QUALITY ASSURANCE

- A. 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.
- B. 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 Washington Administrative Code regulations concerning Listing requirements for electrical equipment.
- C. FACTORY TESTS: Where specified in the individual product specification section, factory tests shall be performed at the place of fabrication and performed on completion of manufacture or assembly. The costs of factory tests shall be included in the contract price.
- D. All portions of the motor control center, vertical bays, and components shall be UL listed and labeled.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 01 66 00.

- B. Ship the motor control center associated equipment to the job site on a dedicated air ride vehicle that will allow the Contractor to utilize onsite off-loading equipment.

1.8 PROJECT OR SITE CONDITIONS

- A. As specified in Section 26 05 00.
- B. Environmental Requirements:
 - 1. The equipment shall be de-rated in accordance with the manufacturer's guidelines for the project altitude and ambient temperature.
- C. Install the equipment per the manufacturer's guidelines and submitted installed instruction to meet the seismic requirements at the project site as defined in the drawings.

1.9 SEQUENCING

- A. Conduct the initial fault current study as specified in Section 26 05 73 and submit results for Engineer's review.
- B. After successful review of the initial fault current study, as specified in Section 26 05 73, submit complete equipment submittal as specified in the Submittals article of this Section for Engineer's review.
- C. Conduct internal factory test to ensure that systems and equipment are functional and submit certified test results for Engineer's review.
- D. Conduct factory acceptance test, to be witnessed by Owner and Owner's representative.
- E. Ship equipment to the Project Site after successful completion of factory acceptance test.
- F. Assemble equipment in the field.
- G. Conduct field acceptance test and submit results for Engineer's review.
- H. Submit manufacturer's certification that the equipment has been properly installed and is fully functional for Engineer's review.
- I. Conduct Owner's training sessions.
- J. Formally energize, start-up and commission equipment.

1.10 SCHEDULING

- A. As specified in Section 26 05 00.

1.11 WARRANTY

- A. As specified in Section 26 05 00.

1.12 SYSTEM START UP

- A. As specified in Section 26 05 00.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. One of the following or approved equal:
 - 1. Allen Bradley.

2.2 EQUIPMENT

- A. General:
 - 1. Furnish motor control centers as specified in the Contract Documents and indicated on the Drawings.
 - 2. Arrange the equipped sections side by side and/or back-to-back to form continuous motor control center lineups as indicated on the Drawings:
 - a. Identify any deviations from the Drawings in writing and submit for approval.
 - 3. Provide wire markers at each end of every wire as specified in Section 26 05 53.
 - 4. Provide complete and functional motor control centers.
 - 5. Provide devices or accessories not specified in this Section but necessary for the proper installation and operation of the equipment.
 - 6. Provide new components of the latest construction series available from the manufacturer.
- B. Design and construct motor control center to operate at the voltage level and configuration indicated on the Drawings.
- C. Bus system:

1. Material:
 - a. Tin-plated copper.
 - b. Short-circuit rating:
 - 1) As indicated on the Drawings.
 - c. Bus bar supports:
 - 1) High impact strength, non-tracking glass-polyester material that is impervious to moisture and gases.
2. Horizontal power bus:
 - a. Current-carrying capacity as indicated on the Drawings.
 - b. Mounting:
 - 1) Mount horizontal bus bars edgewise, one above the other, and fully isolated from all wireways and units.
 - c. Temperature rise:
 - 1) In accordance with UL 845.
 - 2) De-rate the temperature rating of the bus for the project site environmental conditions.
3. Vertical power bus:
 - a. Current-carrying capacity of not less than 300 amps.
 - b. Mounting:
 - 1) Enclose the vertical bus in a polyester-glass cover with small openings to permit unit stabs to mate with the bus:
 - a) Provide a shutter mechanism to cover the stab openings when plug-in units are removed.
 - 2) Provide top and bottom bus covers for insulation and isolation of the ends of the bus.
 - c. Isolated from the unit compartments by a full height barrier.

- d. All unused space shall be covered by hinged blank doors and equipped to accept future units.
4. Ground bus:
- a. Horizontal ground bus:
 - 1) Current-carrying capacity of not less than 600 amps.
 - 2) Mounting:
 - a) Full-width, firmly secured to each vertical section structure:
 - (1) Located in the top or bottom wireway.
 - b) Pre-drilled and furnished with lugs for connection to equipment ground wires:
 - (1) Furnish a minimum of 10 lugs per vertical section of MCC.
 - b. Vertical ground bus.
 - 1) Mounting:
 - a) Furnish in each vertical section.
 - b) Bolted to the horizontal ground bus.
 - c) Install parallel to the vertical power bus.
 - d) Mount vertical ground bus such that plug-in units engage the ground bus before any connection to the power bus is made. Upon removal of plug-in units, ground stabs are disconnected from the ground bus after the power stabs have been disconnected.
5. Bus splice bars:
- a. Provided to join the bus at the splits.
 - b. Connected to each horizontal bus bar with a minimum of two bolts.
 - c. Employ conical or spring washers at connections, designed to maintain constant pressure against the splice joint.
 - d. Same ampacity rating as the horizontal bus.
6. Provide bus system configured for back-to-back MCCs, where required.

D. Enclosures:

1. Each motor control center shall consist of 1 or more vertical sections bolted together:
 - a. Freestanding.
 - b. Totally enclosed.
 - c. Dead-front assembly.
 - d. Designed for modification and/or addition of future vertical sections.
 - e. Form each vertical section of heavy gauge steel.
 - f. Designed for back-to-back arrangement installation, where required and/or as indicated on the Drawings.
2. Enclosure rating:
 - a. Indoor:
 - 1) NEMA 12.
 - 2) NEMA 1 Gasketed.
3. Standard section dimensions:
 - a. Nominal height: 90 inches.
 - b. Nominal depth: 20 inches.
 - c. Nominal width: 20 inches or as indicated on the Drawings.
4. Wireways:
 - a. Provide each vertical section with a horizontal wireway at the top and bottom of the section:
 - 1) Arranged to provide a full-width metal enclosed wiring trough across the entire motor control center assembly.
 - b. Provide each vertical section with a full-height vertical wireway.
 - c. Completely isolated from the vertical and horizontal bus bars.
 - d. Provide a removable, hinged door.

5. Shipping splits:
 - a. No more than 3 vertical sections and not more than 60 inches in width.
 - b. Solid bussing between vertical sections in a shipping split is not acceptable.
 6. Lifting angles:
 - a. Furnish each vertical section and/or shipping split with a removable lifting angle mounted to the top of the enclosure:
 - 1) Extending the entire width of the shipping split.
 7. Mounting channels:
 - 1) Mount each vertical section and/or shipping split on an external 1.5-inch by 3-inch mounting channel.
- E. Units:
1. A plug-in unit consists of:
 - a. Unit assembly.
 - b. Unit support pan.
 - c. Unit door assembly.
 2. Completely enclosed and isolated from adjacent units, buses, and wireways, except for conductor entries into the unit, by a metal enclosure.
 3. Constructed so that any fault will be contained in the unit compartment.
 4. Supported and guided by a removable unit support pan:
 - a. Re-arrangement of units and the removal of a unit so that a new and possibly larger unit can be added without the removal of an in-service unit to gain access to the unit support pan.
 5. Held in place by screws or other positive locking means after insertion.
 6. Provide a test position with the unit supported in the structure but disengaged from the bus.
 7. Integral plug-in ground stab.
 8. Stabs:

- a. Free floating.
 - b. Self-aligning.
 - c. Backed by spring steel clips to ensure high pressure contacts.
 - d. Electrolytically tin-plated copper.
9. Handle:
- a. Provide a flange mounted handle mechanism to operate each disconnect switch or circuit breaker.
 - b. Door mounted operators or operator handles are not acceptable.
 - c. Engaged with the disconnect device at all times as an integral part of the unit independent of the door position.
 - d. Lockable in the "OFF" position with up to 3 padlocks.
 - e. Mechanically interlocked so that the door cannot be opened with the handle in the "ON" position.
 - 1) Provide a means for qualified personnel to defeat this interlock.
 - f. Interlocked so the unit cannot be inserted or withdrawn with the handle in the "ON" position.
 - g. Lockable in the "ON" position:
 - 1) This shall not prevent the circuit breaker from operating and opening the contacts in the event of a fault condition.
 - h. Color-coded to indicate position.
 - i. Located so the center of the grip when it is in its highest position is not more than 6 feet 7 inches above the finished floor, including the height of the housekeeping pad and mounting channels.
10. Where indicated on the Drawings, provide units for spaces and future equipment:
- a. Equip these units to accept a future plug-in unit without modification to the vertical sections.

2.3 COMPONENTS

- A. Provide components contained within the motor control center as shown in the drawings and specified in the sections below:
1. Section 26 05 53, Identification for Electrical Systems.
 2. Section 26 05 19, Low Voltage Electrical Power Conductors and Cables.
 3. Section 26 05 83, Wiring Connections.
 4. Section 26 28 16.13, Enclosed Circuit Breakers.
 5. Section 26 28 16.16, Enclosed Switches.
 6. Section 26 36 23, Automatic Transfer Switches.
 7. Section 26 24 16, Panelboards.
 8. Section 26 22 13, Low Voltage Distribution Transformers.
 9. Section 40 67 00, Process Control Panels and Hardware.
 10. Section 26 43 13, Surge Protection Devices.

2.4 ACCESSORIES

- A. Wiring:
1. Wire the motor control center in accordance with the following NEMA Class and Type as defined by NEMA ICS 18-2001:
 - a. NEMA Class IB
- B. Lugs and terminals:
1. For all external connections of No. 6 AWG wire or larger:
 - a. UL listed for copper or aluminum conductors.
 2. Compression type, requiring a hydraulic press and die for installation.
 3. Provide 20 percent spare control block terminals.
- C. Nameplates:
1. Provide nameplates as specified in Section 26 05 53:
 - a. Identifying the motor control center designation as indicated on the Drawings.
 2. Identifying each vertical section:
 - a. Mounted and centered on the top horizontal wireway of the vertical section.
 3. Furnish individual nameplates for each unit indicated on the Drawings:

- a. 1 nameplate to identify the unit designation.
 - b. 1 nameplate to identify the load served.
 - c. Furnish space units with blank nameplates.
4. Manufacturer's labels:
- a. Furnish each vertical section with a label identifying:
 - 1) Serial number.
 - 2) Bus rating.
 - 3) Vertical section reference number.
 - 4) Date of manufacture.
 - 5) Catalog number of section.
- D. Pilot devices:
- 1. As specified in Section 40 78 19.
 - 2. Provide 30mm size for all pilot devices.
 - 3. Provide LED lights for all pilot lights.

2.5 FINISHES

- A. Finish metal surfaces and structural parts with phosphatizing, or equal, treatment before painting.
- B. Finish interior surfaces including bus support angles, control unit back plates, and top and bottom barrier plates with baked white enamel.
- C. Finish exterior of enclosure with manufacturer's standard gray.

PART 3 EXECUTION

3.1 INSTALLATION

- A. As specified in Section 26 05 00.
- B. Install the equipment in accordance with the accepted installation instructions and anchorage details to meet the seismic and wind load requirements at the Project site.

C. General:

1. Furnish all cables, conduit, lugs, bolts, expansion anchors, sealants, and other accessories necessary to completely install the motor control center for the line, load, and control connections.
2. Assemble and install the motor control center in the locations and with the layouts as indicated on the Drawings.
3. Make bus splice connections.
4. Perform work in accordance with manufacturer's instruction and shop drawings.
5. Furnish all components, and equipment necessary to complete the installation.
6. Replace hardware lost or damaged during installation or handling in order to provide a complete installation.
7. Install the MCC on a 3-1/2-inch raised concrete housekeeping pad:
 - a. Provide structural leveling channels in accordance with the manufacturer's recommendations to provide proper alignment of the units.
 - 1) Remove the manufacturer's supplied mounting channels as required by the manufacturer's installation instructions.
 - b. Weld and/or bolt the motor control center frame to leveling channels.

D. Provide openings in the top or bottom of the motor control center for conduit only.

1. No additional openings will be accepted:
 - a. Mis-cut holes will require that the entire vertical section or removable panel be replaced.
 - b. No hole closers or patches will be accepted.

E. Bundle circuits together and terminate in each unit:

1. Tie with nylon wire ties as specified in Section 26 05 19.
2. Label all wires at each end with wire markers as specified in Section 26 05 53 as shown on the approved elementary schematics.

3.2 FIELD QUALITY CONTROL

- A. As specified in Section 26 05 00.

- B. Provide the services of a manufacturer's representative to:
 - 1. Inspect, verify, and certify that the motor control center installation meets the manufacturer's requirements.

3.3 ADJUSTING

- A. Make all adjustments as necessary and recommended by the Manufacturer, Engineer, or testing firm.
- B. Set all overloads and motor circuit protectors based on the nameplate values of the installed motor.

3.4 CLEANING

- A. As specified in Section 26 05 00.

3.5 DEMONSTRATION AND TRAINING

- A. As specified in Section 26 05 00.
- B. Demonstrate the operation of the motor control center to the Engineer's and Owner's satisfaction.

3.6 PROTECTION

- A. As specified in Section 26 05 00.

END OF SECTION

SECTION 26 29 24

ACTIVE FRONT END LOW VOLTAGE ADJUSTABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Scope.
 - 2. Reference Standards.
 - 3. Quality Assurance.
 - 4. Submittals.
 - 5. Products Requirements.
 - 6. Coordination.
 - 7. Products.
 - 8. Execution.

1.2 SCOPE

- A. This specification specifies low voltage, adjustable frequency drives (AFDs), and variable frequency drives (VFDs). For the purpose of this specification the terms AFD and VFD are interchangeable and equivalent.
- B. The Variable-frequency Drive (VFD) system for motors rated 3Hp and larger shall use an Active Front End (AFE) Low Harmonic design and shall contain all components required to meet the performance, protection, safety and certification criteria of this specification.

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.

- C. Refer to the drawings for control and monitoring requirements including special interlocking requirements.

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/IEEE C37.30A(1984)	Definitions and Requirements for High- Voltage Air Switches, Insulators, and Bus Supports, Supplement to C37.30-1971
ANSI C37.32	Schedules of Preferred Ratings, Manufacturing Specifications and Application Guide for High-Voltage Air Switches, Bus Supports, and Switch Accessories
NEMA ICS 1	General Standards for Industrial Controls and Systems
NEMA ICS 2	Standards for Industrial Control Devices, Controllers and Assemblies
NEMA ICS 3	Industrial Systems
NEMA ICS 3.1	Safety Standards for Construction and Guide for Selection, Installation and Operation of Variable-speed Drive Systems
NEMA ICS 4	Terminal Blocks for Industrial Control Equipment and Systems
NEMA ICS 6	Enclosures for Industrial Controls and Systems
ANSI C37.90	Relays and Relay Systems Associated with Electric Power Apparatus
IEEE 519	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
NFPA 70	National Fire Protection Association – US 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 a period of 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. Submittal requirements specified in: Section 01 33 00.

- B. Product Data: For each type of device and system:
1. A copy of this specification Section with addenda updates, and all referenced Sections, with addenda updates, with each paragraph check-marked to show specification compliance or marked to show deviations.
 2. Catalog and technical data indicating the equipment complies with the Construction Document.
 3. Provide Seismic calculations for anchoring and support of equipment stamped by a Professional Engineer registered in the State of Oregon.
 4. Installation instructions, outline dimensions and weights including filters and/or phase shifting autotransformers, front view drawing identifying control and monitoring devices, nameplate engravings, shipping section dimensions, weight, and foundation requirements or wall mounting requirements for all assemblies.
 5. External connection diagram showing function and identification of all terminals requiring field connections.
 6. O&M manuals per Section 01 33 00 and Section 26 05 00.
 7. Product Data Sheets
 - a. VFD and Operator Interface publications.
 - b. Data sheets and publications on all major components including, but not limited to, the following:
 - 1) Contactors
 - 2) Circuit breaker and fuse (power and control)
 - 3) Control power transformers
 - 4) Pilot devices
 - 5) Relays/Timers
 8. Schematics and wiring diagrams.
 9. Plan drawings showing conduit entry locations.
 10. Current and voltage distortion calculations.
 - a. Point of Common Coupling (PCC)

- b. Include first 36 odd current and voltage harmonics. Voltage shall be calculated on line-to-line basis.
 - c. Provide distortion figures for each harmonic and the total demand distortion.
11. Efficiency and power factor calculations:
- a. Calculate efficiencies of the VFD controller including the auto- transformer (where applicable), ventilation fans, control power and all VFD losses.
 - b. Calculate displacement and total power factor including filter.
 - c. Perform calculations at 100, 75, and 50 percent speed.
 - d. Include first 36 harmonics.
12. Calculations of cooling and ventilation requirements.
13. Certified final factory test procedure and results for each drive.
14. Location and description of service center and spare parts stock.
15. Recommended spare parts list.
16. Factory and field test documentation.
17. Training schedule and materials.
18. Written descriptions explaining ladder diagram operation, system operation, and analog signal processing.
19. Comprehensive interconnection diagrams for VFD and motor.
20. 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.
21. Certification that VFD, motor, and driven load are compatible throughout the specified speed range.
22. Certified statement from the manufacturer accepting responsibility for providing a fully functioning installation as specified herein.

1.6 PRODUCT REQUIREMENTS

- A. The VFD system shall convert 460 volt, 60-Hertz nominal input to a suitable voltage and frequency to cause a premium efficient, inverter duty, squirrel- cage induction motor to run at a speed proportional to an external input analog 4 to 20 ma dc or digital input command as specified for the required VFD speed range.
- B. The VFD system shall include converter units, inverter units, control circuitry, protective equipment, load side DV/dt and sine wave filters, LCL filters and other filters and accessories as necessary to provide the specified functions to meet voltage and current harmonics at the specified point of common connection and to mitigate the motor reflected voltage wave. Unless otherwise specified, the point of common connection for VFDs shall be the 480V-distribution bus (motor control center, distribution panel, etc.) immediately upstream of the VFD.
- C. Active Front End Low Voltage Adjustable Frequency Drives.
 - 1. Listed and labeled by Underwriter’s Laboratories, Inc. (UL), ETL, or Factory Mutual (FM).
 - a. All upgrades to specified requirements per UL or ETL.
 - 2. QUALITY ASSURANCE: The Owner reserves the right to observe factory tests on the VFD controller at the Owner’s option and expense.
 - a. All inspection and testing procedures shall be developed and controlled under the guidelines of the supplier’s quality control system and must be registered to ISO 9001 and audited by a third-party registrar.
 - 3. COMPATIBILITY: VFD controller’s performance shall be compatible and tolerant of disturbances produced by other VFD controllers and not interfere with each other.
 - 4. PROGRAMMING: Provide VFD controller configuration and MACRO or sub-routine programming to meet specified driven equipment requirements.
 - 5. MAINTAINABILITY: VFD controller’s parts shall be interchangeable and modular for all controllers.
- D. FACTORY TEST: Subject complete VFD system to a complete simulated operational test. Drive a calibrated load at various speeds over the specified speed range to determine VFD efficiency.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. See 26 05 00

- B. Contractor shall coordinate shipping of the equipment to the site with the manufacturer/supplier.

1.8 COORDINATION

- A. Obtain and review the appropriate data for the driven motor and load over the required speed range, for a complete system analysis. Verify that equipment is mutually compatible and free of resonance over the complete operating range. Coordinate the assignment of any critical frequencies with the equipment suppliers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Variable frequency drives shall be as manufactured by the vendors listed below. The Owner will not consider substitutions. To conform with specified requirements, a manufacturer's standard product may require modification.

1. Allen Bradley Powerflex 755 TL

2.2 SYSTEM

- A. The System shall use a transistor-based Active Front End as the input rectifier that uses a Selective Harmonic Elimination algorithm, mitigating the harmonics enough to meet IEEE-519-2014 without the need for phase shifting transformers and multi-pulse diode rectifiers. Total current harmonic distortion shall not exceed 5% at the VFD input terminals at full load conditions. AFE rectifier shall be phase rotation insensitive, tolerant of line voltage imbalance up to 10% without affecting the harmonic mitigation or VFD output, and capable of operating the motor at full output with a 10% drop on input voltage.
- B. The unit shall use an LCL filter assembly to filter up to and including the 50th harmonic to reduce EMI/RFI emissions. The LCL filter assembly shall include Passive Dampening. The drive will provide Active Resonance Detection and Protection to minimize any damage to the drive from supply side resonance: Provide integrated, all solid-state variable frequency drives (VFD) complete with incoming line reactors. Provide all components, with terminal numbers as shown on the Drawings.
- C. Operation: Accomplish speed control by adjusting the output frequency according to the desired reference speed. Adjust ac voltage and frequency simultaneously to provide the constant Volts/Hertz necessary to operate the motor at the desired speed. The VFD must use pulse width modulation (PWM) technology.

- D. The drive shall have a built-in circuit breaker as part of the drive's pre-charge circuit (250 hp and up) or provide built-in electrical connections for one to be field connected (10hp-250hp).
- E. The drive will have two sets of tuning settings for the configuration of the line side converter such that appropriate values can be selected for two input sources (example: main utility power or back-up generator) and can be selected from the Human Interface Module or communications network
- F. The VFD shall meet the voltage sag ride-through requirements of SEMI-F47.
- G. Incorporate phase-to-phase and phase-to-ground MOV protection on the AC input line.
- H. Microprocessor-based inverter and converter logic shall be isolated from power circuits.
- I. Use latest generation IGBT inverter and converter sections that shall not require commutation capacitors.
- J. Motor side inverters, line side converters and LCL filter modules (for drives greater than 250 Hp) shall be on roll-out chassis with front accessible connections for ease of repair or replacement and to provide access to load cables. Motor side inverter modules shall be removable without disturbing the load cables after installation.
- K. Line converter modules and load inverter modules sections (for drives greater than 250 Hp) shall be interchangeable so as to reduce necessary spare parts.
- L. Rating:
 - 1. Line Voltage: 480 volts, -5 percent continuous, -10 percent momentary, +10 percent, 3- phase.
 - 2. Line Frequency: 60 Hz, ± 2 Hz
 - 3. Ambient Temperature: 5°C to 40°C
 - 4. Altitude: Up to 3,300 feet above sea level.
 - 5. Power Factor: Above 0.95 at full speed and rated load.
- M. Performance:
 - 1. Efficiency: Above 95 percent at 100 percent full speed, above 93 percent at 70 percent full speed.
 - 2. VFD Inrush Current: Limited to less than 100 percent of motor full load

3. Duty Cycle: 6 starts per hour.
4. Flying Start: The drive shall be capable of determining the speed and direction of a spinning motor and adjust its output to “pick-up” the motor at the rotating speed.

N. Features:

1. Provisions to accept the following control signals for automatic and manual operation:
 - a. Ethernet communications port support Ethernet/IP protocol. All operating parameters and control functions shall be accessible via Ethernet communications.
 - b. FWD & REV Run signal from a single remote contact closure when specified
 - c. A 4-20 mA dc signal for speed control. The VFD shall provide linear speed control of the motor from zero to full speed as the variable speed input signal varies from its minimum to maximum. Input impedance shall be 250 ohms resistive.
2. Have a lineside converter input frequency range from 47 to 63 Hz
3. The carrier frequency of the lineside converter shall be fixed at 4 kHz.
4. The motor side inverter frequency output will be sine coded PWM with a carrier frequency that can be selected at 1.33 kHz, 2 kHz, or 4 kHz.
5. The VFD motor side inverter shall be capable of the following maximum frequency outputs:
 - a. 325 Hz when operating with an output carrier frequency of 1.33kHz or 2 kHz.
 - b. 590 Hz when operating with an output carrier frequency of 4kHz
6. Use gold plated plug-in connections on printed circuit boards.
7. Motor speed indicator calibrated in percent of full speed.
8. A 4-20 mA dc signal for remote speed indication to a local PLC. The VFD shall provide linear speed indication of the motor speed from zero to full speed. Input impedance shall be 250 ohms resistive.
9. A 4-20 mA dc signal for remote motor current indication to a local PLC. The VFD shall provide linear current indication of the motor from zero to full current. Input impedance shall be 250 ohms resistive.

10. Incoming line fused lockable disconnect or lockable main circuit breaker.
 11. 24 VDC control circuitry and 480V-120V step down transformer.
 12. Variable time delay for delaying motor drive restart after power failure; timer range shall be 0 to 120 seconds, with initial settings differing by 10 seconds for each drive; provide module which causes multiple attempts to restart.
 13. Provision for automatic emergency shutdown in any mode, activated by the following:
 - a. Any additional abnormal conditions as shown on the Drawings. Provide for manual restart.
 14. Auxiliary contacts for remote indication of "Run" and "VFD Fault."
 15. VFD operable with motor disconnected, in order to test VFD.
 16. Linearity and repeatability accuracy of 3 phase output of 1 percent of analog input control signal regardless of input power voltage fluctuations between 437 and 505 volts.
 17. Independent acceleration and deceleration controls, adjustable from 2 to 30 Hz per second.
 18. Label with fault current rating per NEC article 409.110 and arc flash warning label per NEC Article 110.16.
- O. Motor Control
1. Selectable Sensorless Vector, Flux Vector, V/Hz, economizer mode selectable through programming.
 2. The drive shall be supplied with an auto-tune mode.
 3. The V/Hz mode shall be programmable for fan curve or full custom patterns.
 4. Capable of Open Loop V/Hz.
 5. Capable of operating induction and permanent magnet motors
- P. Protection: Protect VFD against the following conditions:
1. Reverse phase sequence and single phasing of input power.
 2. Input power failure.

3. Input transient voltages, including peak suppression and snubbers, in accordance with ANSI C37.90.
 4. Transmission signal interference.
 5. Output overcurrent.
 6. Input overcurrent.
 7. Motor over temperature.
 8. Cabinet over temperature.
 9. Under voltage: VFD shall automatically shut down if input voltage falls below preset limit with automatic restart upon return to a stable supply.
- Q. Enclosure Door Mounted Human Interface Module (HIM)
1. VFD shall provide a HIM with integral LCD display, operating keys and programming keys.
 2. An enclosure door-mounted HIM, rated UL Type 12, shall be provided
 3. The HIM shall have the following features:
 4. A four (4) to seven (7) line backlit LCD display with graphics capability.
 5. Shall indicate drive operating conditions, adjustments and fault indications.
 6. Shall be configured to display in the following:
 7. One zone shall display the status of direction, drive condition, fault / alarm conditions and Auto / Manual mode.
 8. Another zone shall display drive output frequency, voltage or current.
 9. Another Zone shall display one of 6 to 12 user selected values such as power, torque, DC bus voltage, Analog values, discrete I/O status and etc.
 10. The keypad shall include programming keys, drive operating keys (Start, Stop, Direction, Jog and Speed Control), and numeric keys for direct entry.
- R. Construction:
1. All stand-alone VFDs provided for this project shall be of the same manufacturer chosen from Paragraph 2.1 above.

2. VFDs mounted in motor control centers (MCCs) shall be of the same manufacturer as the MCC.
 - a. Door-mount the following devices:
 - 1) HMI with the following indications:
 - a) Power On
 - b) Speed indication
 - c) Motor Run
 - d) VFD Fault Indication
 - e) External operating handle for the incoming line fused disconnect.
 - b. Control components shall be in accordance Section 26 27 16. Configuration of the enclosure and the components shall be as shown on the drawings.
 - c. Components: Mount components on circuit cards or modules, which can be adjusted or replaced in the field without the use of special tools.
 - d. Finish: Paint finish shall be ANSI Grey.
 - S. Spare Parts: Furnish two sets of spare power fuses for each size and type of fuse used; furnish a minimum of five fuses of each size and type of control circuit fuse.

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. Properly level and plumb VFDs so that doors will open and close freely.
- C. Clean and repair scratched or damaged surfaces to "new" condition.
- D. Provide the services of a factory trained service technician to inspect and check out each system before energizing.
- E. Per manufacturer's instructions, lace power conductors to resist short circuit forces.

3.2 COMPONENT TEST PHASE

- A. PROCEDURES: Section 01 75 16

- B. Operate each drive from no load to full load and perform a spectrum analysis to verify that the waveform on the line side of the VFD is in compliance with IEEE 519 for general systems.

3.3 MANUFACTURER'S SERVICES

- A. ON-SITE INSPECTIONS AND TRAINING: Provide a factory-trained manufacturer's representative at the Site for the following activities. Specified durations do not include travel time to or from the Site.
 - 1. INSTALLATION INSPECTIONS: Assist, supervise, and inspect the Contractor's activities during installation. Provide 8 hours of installation inspection.
 - 2. TRAINING SESSIONS: Procedures: Section 01 75 16. Coordinate training with operations and maintenance staff schedules to ensure all required staff can attend.

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 an Automatic Transfer Switch (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the drawings. Each automatic transfer switch shall consist of a contactor style or inherently double throw power transfer switch mechanism and a microprocessor controller, interconnected to provide complete automatic operation.
- B. Furnish an enclosure for the ATS that is suitable for the application. It shall provide all of the proper disconnecting, protection, grounding and bonding required for service entrance equipment.
- C. 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, 1200 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. Unit shall be Delayed Transition style.

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 Automatic Transfer Switches
 - b. CSA 22.2 No 178
 - c. IEC 60947-6-1
 - d. NFPA 70 - National Electrical Code
 - e. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
 - f. NEC Articles 700, 701, 702
 - g. NFPA 110 - Emergency and Standby Power Systems
 - h. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - i. International Standards Organization ISO 9001: 2008
 - j. UL 508 Industrial Control Equipment

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.
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.

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. Asco 7000 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 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.
- C. 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.

- D. 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.
- E. Each transfer switch shall be positively interlocked both mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation. Main contacts shall be mechanically locked in position in both normal and emergency positions. A neutral position shall not be possible under normal electrical operation unless a delayed transition accessory is required for switching highly inductive loads.
- F. Transfer switches shall be capable of being operated manually under full rated load conditions. Manual operation shall be accomplished by a permanently attached manual operator, or by integrally mounted pushbuttons. Removable manual operating handles and handles that may move in the event of an electrical operation during the manual operation, are not acceptable. Manual operators requiring source or load disconnection prior to manual operation are not acceptable.
- G. On transfer switches requiring a fourth pole for switching the neutral, the neutral shall be fully rated with equal withstand, closing and interrupting ratings to the power poles. Switched neutral poles which are add-on or overlap, or that are not capable of breaking full rated load current are not acceptable.
- H. 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 0-5 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 2-60 seconds (adjustable) after attainment of 90% of rated voltage and frequency of that source.
- I. When the normal power source has been restored to 90% of rated voltage and after a time delay adjustable from 0-30 minutes (to ensure the integrity of the normal power source), the load shall be retransferred to the normal source.
- J. A time delay, adjustable 0-10 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.
- K. 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.
- L. 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. Pilot lights to indicate to which source the load is connected.
 3. Pilot lights to indicate that an integral overcurrent protective device has tripped.
 4. Plant exerciser timer 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
 - c. "Normal" power source available
 - d. ATS failure (common failure alarm)
- M. Each transfer switch shall be provided in a NEMA 1 enclosure suitable for use in environments indicated in the drawings.
1. NEMA 1 enclosures shall be painted with the manufacturer's standard light gray ANSI 61 paint.
- N. Unless otherwise specified, all electrical enclosures in damp and wet locations shall be NEMA 4, stainless steel.
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.

PART 3 PART 3 EXECUTION

3.1 INSTALLATION

- A. Install as shown on the drawings and in accordance with manufacturer's instructions and requirements.

- B. All necessary hardware to secure the assembly in place shall be provided by the contractor.

3.2 TESTING

- A. Service Equipment shall be tested for proper operation and function in accordance with manufacturers testing instructions and the requirements of the contract documents.
- 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.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTIVE DEVICES FOR LOW- VOLTAGE ELECTRICAL POWER CIRCUITS

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. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers (MCC).
- B. Provide a transient voltage suppression system that is suitable for application in IEEE C62.41 Category A, B and C3 environments, as tested by IEEE C2.11, C62.45.

1.3 REFERENCE STANDARDS

- A. Provide SPD unit designed, manufactured, tested and installed in compliance with the following codes and standards:
 - 1. IEEE C62.41, C62.43, C62.45, C62.48, C62.62 Institute of Electrical and Electronic Engineers
 - 2. NEMA LS-1 National Electrical Manufacturer Association
 - 3. NFPA 20, 75 and 780 National Fire Protection Association
 - 4. NFPA 70 National Electric Code
 - 5. UL 1449 4th Edition or later, UL 1283 5th Edition or later and UL 96A Underwriters Laboratories

6. IEC 801 International Electrotechnical Commission

1.4 QUALITY ASSURANCE

- A. REQUIREMENTS: Section 26 05 00 Common Work Results for Electrical.
- B. Furnish a manufacturer's full 5-year parts and labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements, and any applicable national, state, or local electrical codes.

1.5 DEFINITIONS

- A. TVSS - Transient Voltage Surge Suppression.
- B. SAD - Silicon Avalanche Diode.
- C. MOV - Metal Oxide Varistor.
- D. SPD - Surge protective device.

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. Submit independent test data from a nationally recognized testing laboratory verifying the following:
 - a. Lifecycle testing
 - b. Overcurrent protection
 - c. UL 1449 4th Edition or later.
 - d. Surge current capacity.
- C. Shop Drawings:
 1. Provide electrical and mechanical drawings by the manufacturer that detail:
 - a. Unit dimensions.
 - b. Weights.
 - c. Components
 - d. Field connection locations.
 - e. Mounting provisions.
 - f. Connection details.
 - g. Wiring diagram.
- D. Operation and Maintenance Manuals:
 1. Provide the manufacturer's manual with installation, start-up, spare parts lists, and operating instructions for the specified system.

1.7 COORDINATION

- A. Coordinate with and provide SPD equipment to the electrical equipment manufacturer before final assembly and factory testing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. One of the following or equal:
 - 1. Liebert.
 - 2. Eaton/Cutler Hammer.
 - 3. Square D.
 - 4. General Electric.

2.2 MANUFACTURED UNITS

- A. Electrical Requirements
 - 1. SPD ratings shall be consistent with the nominal system operating voltage, phase, and configuration.
 - 2. Maximum Continuous Operating Voltage (MCOV):
 - a. The MCOV shall not be less than 115% of the nominal system operating voltage.
 - 3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards. End of life mode to be open circuit. Unit with end of life short-circuit mode are not acceptable.
 - 4. Unit shall operate without the need for an external overcurrent protection device (OCPD) and be listed by UL as such. Unit must not require external OCPD or replaceable internal OCPD for the UL Listing.
 - 5. Operating Frequency:
 - a. 47 to 63 hertz.

6. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.

B. Protection Modes:

1. Provide SPD protection modes as follows:

- a. Line to Neutral (L-N).
- b. Line to Ground (L-G).
- c. Neutral to Ground (N-G).
- d. Line to Line (L-L).

C. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

	Nominal Voltage	Configuration	L-N (Volts)	N-G (Volts)	L-G (Volts)	L-L (Volts)
Wye Models	120/208	Grounded Wye	700	700	700	1200
	277/480	Grounded Wye	1200	1200	1200	2000
	347/600	Grounded Wye	1500	1500	1500	3000

D. Environmental Requirements:

- 1. Storage Temperature:
 - a. -40 degrees to +60 degrees Celsius.
- 2. Operating Temperature:
 - a. 20 degrees to +60 Celsius.
- 3. Relative Humidity:
 - a. 5 percent to 95 percent.
- 4. Audible Noise:
 - a. Less than 45 dBa at 5 feet (1.5 m).
- 5. Operating Altitude:
 - a. Zero to 12,000 feet above sea level.

- E. Enclosure:
 - 1. Located in electrical equipment where indicated on the Drawings.
- F. Internal Connections:
 - 1. Provide low impedance copper plates for intra-unit connections:
 - a. Attach surge modules using bolted connections to the plates for low impedance connections.
 - 2. Size all connections, conductors, and terminals for the specified surge current capacity.

2.3 COMPONENTS

- A. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable single-mode modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
- B. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
- C. Electrical Noise Filter – Each Type 2 unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable to meet this specification shall not be accepted.
 - 1. Type 2 units with filtering shall conform to UL 1283 5th Edition.
 - 2. Type 1 units shall not contain filtering or have a UL 1283 5th Edition Listing.
- D. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
- E. Thermal MOV Protection
 - 1. The unit shall contain thermally protected MOVs. These self-protected MOVs shall have a thermal protection element integrated with the MOV and a mechanical disconnect with arc quenching capabilities in order to achieve overcurrent

protection of the MOV. The thermal protection assembly shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

- F. Fully Integrated Component Design – All of the SPD’s components and diagnostics shall be contained within one discrete assembly. The use of plug in single-mode modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
- G. Safety Requirements
 - 1. The SPD shall minimize potential arc flash hazards by containing no single-mode plug in user serviceable / replaceable parts and shall not require periodic maintenance. SPDs containing items such as replaceable single-mode plug in modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
 - 2. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.4 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

2.5 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
 - 1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
 - 2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
 - 3. The panelboard shall be capable of re-energizing upon removal of the SPD.
 - 4. The SPD shall be integral to the panelboard and connected directly to the bus. Alternately, an integral SPD can be connected to a circuit breaker for disconnecting purposes, in the case a disconnect is required.
 - 5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
 - 6. The SPD shall be of the same manufacturer as the panelboard.
 - 7. The complete panelboard including the SPD shall be UL67 listed.

2.6 SWITCHGEAR, SWITCHBOARD, MCC AND BUSWAY REQUIREMENTS

- A. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
- B. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, or busway.
- C. The SPD shall be factory installed integral to the switchgear, switchboard, MCC, and/or bus plug at the assembly plant by the original equipment manufacturer.
- D. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
- E. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.

- F. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
- G. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.7 SERVICE ENTRANCE REQUIREMENTS

- A. Service entrance located SPDs shall be tested and designed for applications within ANSI/IEEE C62.41 Category C environments.

2.8 ACCESSORIES

- A. Unit status indicators:
 - 1. Provide red and green solid-state indicators, with printed labels, on the hinged front cover to redundantly indicate on-line unit status:
 - a. The absence of the green light and the presence of the red light indicates that surge protection is reduced and service is needed to restore full operation.
- B. Dry contacts for remote monitoring:
 - 1. Electrically isolated Form C dry contacts (10A/125VAC) for remote monitoring of system integrity, and indication of under voltage, phase and/or power loss.
- C. Provide on-line circuit, which tests and redundantly monitors individual components in all protection modes including neutral to ground:
 - 1. Units that require external test sets or equipment are unacceptable.
- D. Provide an integral disconnect switch located in-line with the SPD system enclosure:
 - 1. External manual operator.
 - 2. The switch shall disconnect all ungrounded circuit conductors from the SPD.
 - 3. The integral disconnect switch shall be capable of withstanding, without failure, the maximum published surge current magnitude and short circuit current without failure or damage to the switch.
- E. Interconnection Cable:
 - 1. Interconnect the SPD to the power system using a manufacturer furnished assembly of low impedance coaxial cables installed in flexible conduit.
 - 2. Cable designed to transmit transients with minimal voltage drop.

3. UL listed.

2.9 SOURCE QUALITY CONTROL

- A. Permanently affix surge rating to the SPD.
- B. Test the system at the component and fully assembled level, under surge conditions with alternating current power applied for a minimum of 1 hour:
 1. Testing includes but not limited to:
 - a. Quality control checks.
 - b. Dielectric voltage withstand test per UL requirements.
 - c. UL ground continuity tests.
 - d. Operational and calibration tests.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Refer to Section 26 05 00.
- B. Special Techniques:
 1. Install the SPD with as short and straight conductors including ground conductor as practically possible.
 2. Twist the SPD input conductors together to reduce input conductor inductance.
 3. Follow the SPD manufacturer's recommended installation practices and comply with all applicable codes.
 4. Interconnect the SPD to the power system using a manufacturer supplied interconnection cable consisting of low impedance coaxial cables installed in a flexible conduit.
 5. Do not subject SPD to insulation resistance testing.

END OF SECTION

SECTION 40 78 19

SWITCHES AND PUSH BUTTONS

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 specifies requirements for supply and installation of push buttons and indicating lights

1.3 REFERENCE STANDARDS

- A. ASTM – American Society for Testing and Materials
- B. NEMA – National Electrical Manufacturer’s Association
- C. NEC – National Electrical Code
- D. NFPA No. 70, NEC - National Electrical Code
- E. NFPA No. 79, Electrical Standard for Industrial Machinery.
- F. ISA – Instrumentation, Systems, and Automation Society.
- G. ICS-1 – General Standards for Industrial Control and System
- H. ICS-2 – Standards for Industrial Control Devices, Controllers and
- I. ICS-3 – Industrial Systems.
- J. UL – Underwriter’s Laboratory UL (Note: Other Nationally Recognized Testing Laboratories [NRTL], such as ETL, may be used in lieu of UL.)

1. Standard 508 (Industrial Control Panels for General Use).
 2. Standard 698 (Industrial Control Panels Relating to Hazardous (Classified) Locations)
 3. Standard 913 (Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations)
- K. NETA – National Electrical Testing Association.

1.4 QUALITY ASSURANCE

- A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions
- 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. Submittals requirements specified in: Section 01 33 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. Mark data sheets to clearly show exact product and options being provided
- C. Manufacturer's installation instructions.
- D. Operation and Maintenance Manual if applicable.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Candidate manufacturers and models include the following
 1. Allen-Bradley, Bulletin 800T.
 2. Square D. Co., Type T.A
 3. Approved Equal

2.2 GENERAL

- A. Pilot Devices shall be provided as a Panel Assembly component where indicated, specified, or required to perform the functional requirements of the System, as specified. All Pilot Devices shall meet the following minimum specifications, unless otherwise noted.
1. All pilot devices shall be of heavy-duty, metallic, type 4/13, watertight/oiltight construction. Units shall mount through a 30.5 mm round hole.
 2. All pilot devices shall have custom legends as shown. Legends shall be black with white letters, and letter height shall be minimum 3/16-inch high characters.
 3. All button and lens colors shall be as shown. Color code is as follows:
 4. A = Amber, B = Blue, G = Green, R = Red, Y = Yellow, W = White
 5. All pilot devices shall be equipped with a sufficient number of contact blocks to accomplish the switching functions specified.
 6. All selector switches shall be knob type.
 7. Illuminated selector switches shall be 120-volt AC, full voltage type with LED lamps where specified.
- B. Pushbuttons shall meet the following minimum specifications, unless otherwise noted.
1. All pushbuttons shall be flush type.
 2. All emergency stop pushbuttons shall be red colored, jumbo mushroom head, push operate / twist release type, with one form C contact, minimum. Emergency stop pushbutton legends shall be red with white letters, and letter height shall be minimum 3/16-inch high characters.
 3. Unless otherwise shown, all other pushbuttons shall be black in color.
 4. Illuminated push buttons shall be 120-volt AC, full voltage type with LED lamps where specified.
- C. Indicating lights shall meet the following minimum specifications, unless otherwise noted.
1. All indicating lights shall be full voltage type with LED lamps. Units shall be rated for the voltage shown.
 2. All indicating lights shall be "push-to-test" type.

3. All indicating light lenses shall be plastic.

PART 3 EXECUTION

3.1 INSTALLATION

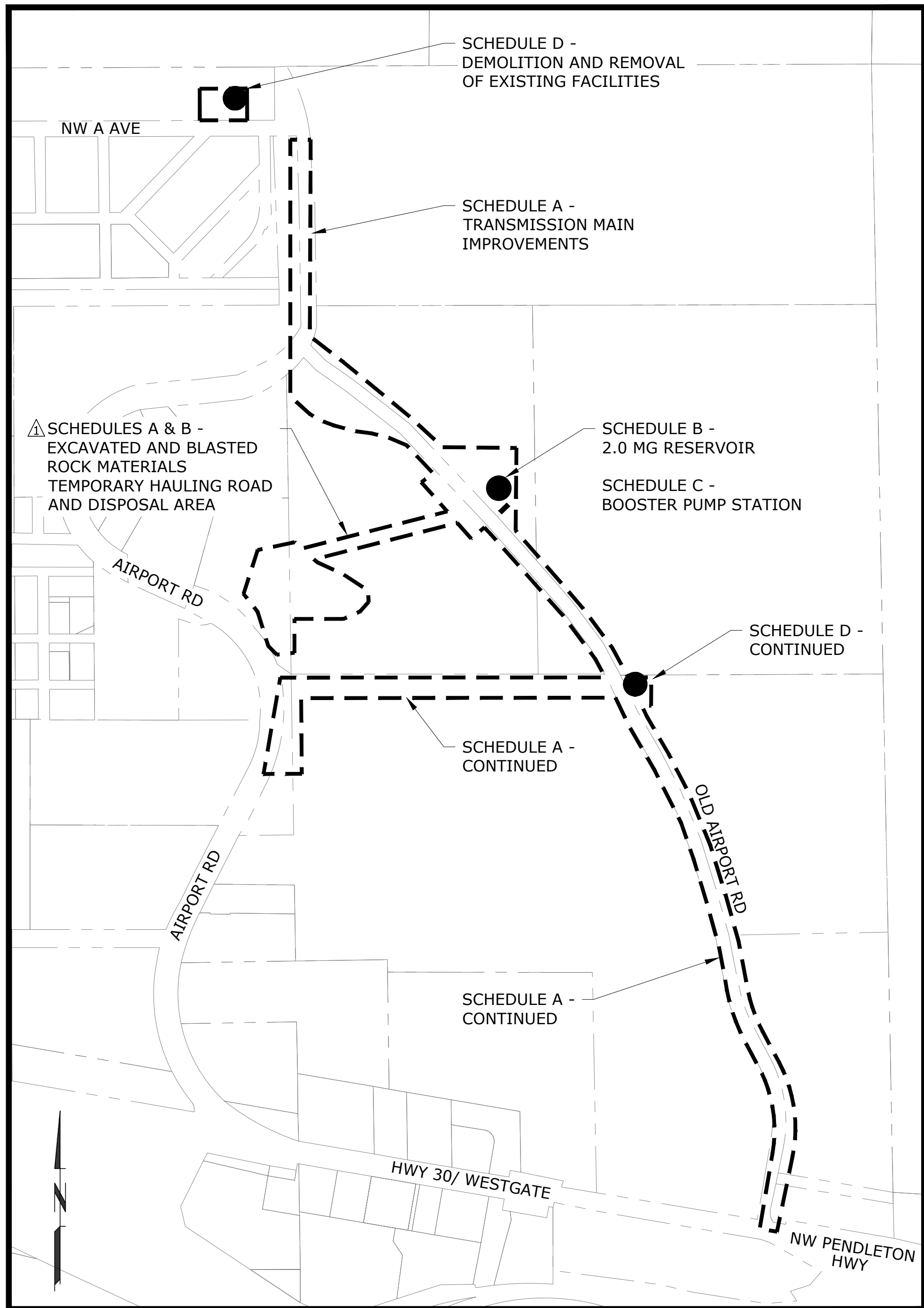
- A. REQUIREMENTS: Section 40 61 13 and Install in accordance with manufacturer's instructions for the specified functional requirements.
- B. Install all components in accordance with manufactures specifications and instructions.
- C. Components shall be installed and tested on site in accordance with the requirements of Section 40 61 13 and in accordance with the manufacturer's recommendations.

3.2 TESTING

- A. REQUIREMENTS: Section 40 61 21.
- B. Ensure proper installation per manufacturers recommendations

END OF SECTION

ESC PLAN FOR 1200-C SITES



SHEET INDEX EROSION AND SEDIMENT CONTROL PLANS

- ESC-1 EROSION & SEDIMENT CONTROL PLAN COVER SHEET
- ESC-2 EROSION & SEDIMENT CONTROL PLAN ESC PLAN OVERVIEW
- ESC-3 EROSION & SEDIMENT CONTROL PLAN SCHEDULE A - TRANSMISSION MAIN IMPROVEMENTS
- ESC-4 EROSION & SEDIMENT CONTROL PLAN SCHEDULES B & C - RESERVOIR AND BPS SITE
- ESC-4B EROSION & SEDIMENT CONTROL PLAN SCHEDULES A & B - EXCAVATED AND BLASTED ROCK MATERIALS DISPOSAL
- ESC-5 EROSION & SEDIMENT CONTROL DETAILS

OWNER / SURVEYOR:

CITY OF PENDLETON, DEPT OF PUBLIC WORKS
500 SW DORIAN AVENUE
PENDLETON, OR 97201
CONTACT: BOB PATTERSON, P.E., CITY PUBLIC WORKS MANAGER
PHONE: (541) 966-0202
FAX: (541) 966-0251

PLANNING / ENGINEERING:

MURRAYSMITH
888 SW 5TH AVENUE, SUITE 1170
PORTLAND, OR 97204
CONTACT: LAEL ALDERMAN, P.E.
PHONE: (503) 225-9010
FAX: (503) 225-9022

NARRATIVE DESCRIPTIONS:

EXISTING SITE CONDITIONS

* UNDEVELOPED SITE; CITY OF PENDLETON OWNED LIGHT INDUSTRIAL; UMATILLA COUNTY ROADWAYS AND RIGHTS-OF-WAY

DEVELOPED CONDITIONS

* WATER RESERVOIR, PUMP STATION BUILDING, ASSOCIATED UTILITIES (WATER AND STORM PIPING), AND WATER MAIN

NATURE OF CONSTRUCTION ACTIVITY AND ESTIMATED TIME TABLE

- * MASS EXCAVATION AND GRADING (2/2022-3/2022)
- * CONSTRUCTION OF RESERVOIR AND PUMP STATION (3/2022-12/2022)
- * FINAL SITE GRADING (11/2022-12/2022)

△ DISTURBED AREAS = SCHEDULE A: TRANSMISSION MAIN = 6.8 ACRES
SCHEDULES B & C: RESERVOIR & PUMP STATION = 6.0 ACRES

△ TOTAL DISTURBED AREA = 12.8 ACRES

SITE SOIL CLASSIFICATION

PITS, GRAVEL; ANDERLY SILT LOAM, 7 TO 20 PERCENT SLOPES; WALLA WALLA SILT LOAM, 1 TO 12 PERCENT SLOPES

ATTENTION EXCAVATORS:

OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. YOU MAY OBTAIN COPIES OF THESE RULES FROM THE CENTER BY CALLING 503-232-1987. IF YOU HAVE ANY QUESTIONS ABOUT THE RULES, YOU MAY CONTACT THE CENTER. YOU MUST NOTIFY THE CENTER AT LEAST TWO BUSINESS DAYS, BEFORE COMMENCING AN EXCAVATION. CALL 503-246-6699.

INSPECTION FREQUENCY:

SITE CONDITION	MINIMUM FREQUENCY
1. ACTIVE PERIOD	DAILY WHEN STORMWATER RUNOFF, INCLUDING RUNOFF FROM SNOWMELT, IS OCCURRING. AT LEAST ONCE EVERY TWO WEEKS, REGARDLESS OF WHETHER OR NOT RUNOFF IS OCCURRING.
2. PRIOR TO THE SITE BECOMING INACTIVE OR IN ANTICIPATION OF SITE INACCESSIBILITY.	ONCE TO ENSURE THAT EROSION AND SEDIMENT CONTROL MEASURES ARE IN WORKING ORDER. ANY NECESSARY MAINTENANCE AND REPAIR MUST BE MADE PRIOR TO LEAVING THE SITE.
3. INACTIVE PERIODS GREATER THAN FOURTEEN (14) CALENDAR DAYS.	ONCE EVERY TWO (2) WEEKS.
4. PERIODS DURING WHICH THE SITE IS INACCESSIBLE DUE TO INCLEMENT WEATHER.	IF PRACTICAL, INSPECTIONS MUST OCCUR DAILY AT A RELEVANT AND ACCESSIBLE DISCHARGE POINT OR DOWNSTREAM LOCATION.

- * HOLD A PRE-CONSTRUCTION MEETING OF PROJECT CONSTRUCTION PERSONNEL THAT INCLUDES THE INSPECTOR TO DISCUSS EROSION AND SEDIMENT CONTROL MEASURES AND CONSTRUCTION LIMITS. (SCHEDULE A.8.C.1.(3))
- * ALL INSPECTIONS MUST BE MADE IN ACCORDANCE WITH DEQ 1200-C PERMIT REQUIREMENTS.
- * INSPECTION LOGS MUST BE KEPT IN ACCORDANCE WITH DEQ'S 1200-C PERMIT REQUIREMENTS.
- * RETAIN A COPY OF THE ESCP AND ALL REVISIONS ON SITE AND MAKE IT AVAILABLE ON REQUEST TO DEQ, AGENT, OR THE LOCAL MUNICIPALITY. DURING INACTIVE PERIODS OF GREATER THAN SEVEN (7) CONSECUTIVE CALENDAR DAYS, RETAIN THE ESCP AT THE CONSTRUCTION SITE OR AT ANOTHER LOCATION. (SCHEDULE B.2.A)

STANDARD EROSION AND SEDIMENT CONTROL PLAN DRAWING NOTES:

1. ALL PERMIT REGISTRANTS MUST IMPLEMENT THE ESCP. FAILURE TO IMPLEMENT ANY OF THE CONTROL MEASURES OR PRACTICES DESCRIBED IN THE ESCP IS A VIOLATION OF THE PERMIT.
2. THE ESCP MEASURES SHOWN ON THIS PLAN ARE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, UPGRADE THESE MEASURES AS NEEDED TO COMPLY WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL EROSION AND SEDIMENT CONTROL REGULATIONS. SUBMISSION OF ALL ESCP REVISIONS IS NOT REQUIRED. SUBMITTAL OF THE ESCP REVISIONS IS ONLY UNDER SPECIFIC CONDITIONS. SUBMIT ALL NECESSARY REVISION TO DEQ OR AGENT.
3. PHASE CLEARING AND GRADING TO THE MAXIMUM EXTENT PRACTICAL TO PREVENT EXPOSED INACTIVE AREAS FROM BECOMING A SOURCE OF EROSION.
4. IDENTIFY, MARK, AND PROTECT (BY FENCING OFF OR OTHER MEANS) CRITICAL RIPARIAN AREAS AND VEGETATION INCLUDING IMPORTANT TREES AND ASSOCIATED ROOTING ZONES, AND VEGETATION AREAS TO BE PRESERVED. IDENTIFY VEGETATIVE BUFFER ZONES BETWEEN THE SITE AND SENSITIVE AREAS (E.G., WETLANDS), AND OTHER AREAS TO BE PRESERVED, ESPECIALLY IN PERIMETER AREAS.
5. PRESERVE EXISTING VEGETATION WHEN PRACTICAL AND RE-VEGETATE OPEN AREAS. RE-VEGETATE OPEN AREAS WHEN PRACTICABLE BEFORE AND AFTER GRADING OR CONSTRUCTION. IDENTIFY THE TYPE OF VEGETATIVE SEED MIX USED.
6. EROSION AND SEDIMENT CONTROL MEASURES INCLUDING PERIMETER SEDIMENT CONTROL MUST BE IN PLACE BEFORE VEGETATION IS DISTURBED AND MUST REMAIN IN PLACE AND BE MAINTAINED, REPAIRED, AND PROMPTLY IMPLEMENTED FOLLOWING PROCEDURES ESTABLISHED FOR THE DURATION OF CONSTRUCTION, INCLUDING PROTECTION FOR ACTIVE STORM DRAIN INLETS AND CATCH BASINS AND APPROPRIATE NON-STORMWATER POLLUTION CONTROLS.
7. ESTABLISH CONCRETE TRUCK AND OTHER CONCRETE EQUIPMENT WASHOUT AREAS BEFORE BEGINNING CONCRETE WORK.
8. APPLY TEMPORARY AND/OR PERMANENT SOIL STABILIZATION MEASURES IMMEDIATELY ON ALL DISTURBED AREAS AS GRADING PROGRESSES AND FOR ALL ROADWAYS INCLUDING GRAVEL ROADWAYS.
9. ESTABLISH MATERIAL AND WASTE STORAGE AREAS, AND OTHER NON-STORMWATER CONTROLS.
10. PREVENT TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS USING BMPs SUCH AS: GRAVELED (OR PAVED) EXITS AND PARKING AREAS, GRAVEL ALL UNPAVED ROADS LOCATED ON-SITE, OR USE AN EXIT TIRE WASH. THESE BMPs MUST BE IN PLACE PRIOR TO LAND-DISTURBING ACTIVITIES.
11. WHEN TRUCKING SATURATED SOILS FROM THE SITE, EITHER USE WATER-TIGHT TRUCKS OR DRAIN LOADS ON SITE.
12. USE BMPs TO PREVENT OR MINIMIZE STORMWATER EXPOSURE TO POLLUTANTS FROM SPILLS; VEHICLE AND EQUIPMENT FUELING, MAINTENANCE, AND STORAGE; OTHER CLEANING AND MAINTENANCE ACTIVITIES; AND WASTE HANDLING ACTIVITIES. THESE POLLUTANTS INCLUDE FUEL, HYDRAULIC FLUID, AND OTHER OILS FROM VEHICLES AND MACHINERY, AS WELL AS DEBRIS, LEFTOVER PAINTS, SOLVENTS, AND GLUES FROM CONSTRUCTION OPERATIONS.
13. IMPLEMENT THE FOLLOWING BMPs WHEN APPLICABLE: WRITTEN SPILL PREVENTION AND RESPONSE PROCEDURES, EMPLOYEE TRAINING ON SPILL PREVENTION AND PROPER DISPOSAL PROCEDURES, SPILL KITS IN ALL VEHICLES, REGULAR MAINTENANCE SCHEDULE FOR VEHICLES AND MACHINERY, MATERIAL DELIVERY AND STORAGE CONTROLS, TRAINING AND SIGNAGE, AND COVERED STORAGE AREAS FOR WASTE AND SUPPLIES.
14. USE WATER, SOIL-BINDING AGENT OR OTHER DUST CONTROL TECHNIQUE AS NEEDED TO AVOID WIND-BLOWN SOIL.
15. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS TO MINIMIZE NUTRIENT RELEASES TO SURFACE WATERS. EXERCISE CAUTION WHEN USING TIME-RELEASE FERTILIZERS WITHIN ANY WATERWAY RIPARIAN ZONE.
16. IF A STORMWATER TREATMENT SYSTEM (FOR EXAMPLE, ELECTRO-COAGULATION, FLOCCULATION, FILTRATION, ETC.) FOR SEDIMENT OR OTHER POLLUTANT REMOVAL IS EMPLOYED, SUBMIT AN OPERATION AND MAINTENANCE PLAN (INCLUDING SYSTEM SCHEMATIC, LOCATION OF SYSTEM, LOCATION OF INLET, LOCATION OF DISCHARGE, DISCHARGE DISPERSION DEVICE DESIGN, AND A SAMPLING PLAN AND FREQUENCY) BEFORE OPERATING THE TREATMENT SYSTEM. OBTAIN PLAN APPROVAL BEFORE OPERATING THE TREATMENT SYSTEM. OPERATE AND MAINTAIN THE TREATMENT SYSTEM ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
17. TEMPORARILY STABILIZE SOILS AT THE END OF THE SHIFT BEFORE HOLIDAYS AND WEEKENDS, IF NEEDED. THE REGISTRANT IS RESPONSIBLE FOR ENSURING THAT SOILS ARE STABLE DURING RAIN EVENTS AT ALL TIMES OF THE YEAR.
18. AT THE END OF EACH WORKDAY SOIL STOCKPILES MUST BE STABILIZED OR COVERED, OR OTHER BMPs MUST BE IMPLEMENTED TO PREVENT DISCHARGES TO SURFACE WATERS OR CONVEYANCE SYSTEMS LEADING TO SURFACE WATERS.
19. CONSTRUCTION ACTIVITIES MUST AVOID OR MINIMIZE EXCAVATION AND CREATION OF BARE GROUND DURING WET WEATHER.
20. SEDIMENT FENCE: REMOVE TRAPPED SEDIMENT BEFORE IT REACHES ONE THIRD OF THE ABOVE GROUND FENCE HEIGHT AND BEFORE FENCE REMOVAL.
21. OTHER SEDIMENT BARRIERS (SUCH AS BIOBAGS): REMOVE SEDIMENT BEFORE IT REACHES TWO INCHES DEPTH ABOVE GROUND HEIGHT, AND BEFORE BMP REMOVAL.
22. CATCH BASINS: CLEAN BEFORE RETENTION CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT. SEDIMENT BASINS AND SEDIMENT TRAPS: REMOVE TRAPPED SEDIMENTS BEFORE DESIGN CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT AND AT COMPLETION OF PROJECT.
23. WITHIN 24 HOURS, SIGNIFICANT SEDIMENT THAT HAS LEFT THE CONSTRUCTION SITE, MUST BE REMEDIATED. INVESTIGATE THE CAUSE OF THE SEDIMENT RELEASE AND IMPLEMENT STEPS TO PREVENT A RECURRENCE OF THE DISCHARGE WITHIN THE SAME 24 HOURS. ANY IN-STREAM CLEAN UP OF SEDIMENT SHALL BE PERFORMED ACCORDING TO THE OREGON DIVISION OF STATE LANDS REQUIRED TIMEFRAME.
24. THE INTENTIONAL WASHING OF SEDIMENT INTO STORM SEWERS OR DRAINAGE WAYS MUST NOT OCCUR. VACUUMING OR DRY SWEEPING AND MATERIAL PICKUP MUST BE USED TO CLEANUP RELEASED SEDIMENTS.
25. PROVIDE PERMANENT EROSION CONTROL MEASURES ON ALL EXPOSED AREAS. DO NOT REMOVE TEMPORARY SEDIMENT CONTROL PRACTICES UNTIL PERMANENT VEGETATION OR OTHER COVER OF EXPOSED AREAS IS ESTABLISHED. HOWEVER, DO REMOVE ALL TEMPORARY EROSION CONTROL MEASURES AS EXPOSED AREAS BECOME STABILIZED, UNLESS DOING SO CONFLICTS WITH LOCAL REQUIREMENTS. PROPERLY DISPOSE OF CONSTRUCTION MATERIALS AND WASTE, INCLUDING SEDIMENT RETAINED BY TEMPORARY BMPs.
26. THE ENTIRE SITE MUST BE TEMPORARILY STABILIZED USING VEGETATION OR A HEAVY MULCH LAYER. TEMPORARY SEEDING, OR OTHER METHOD SHOULD ALL CONSTRUCTION ACTIVITIES CEASE FOR 30 DAYS OR MORE.
27. PROVIDE TEMPORARY STABILIZATION FOR THAT PORTION OF THE SITE WHERE CONSTRUCTION ACTIVITIES CEASE FOR 14 DAYS OR MORE WITH A COVERING OF BLOWN STRAW AND A TACKIFIER, LOOSE STRAW, OR AN ADEQUATE COVERING OF COMPOST MULCH UNTIL WORK RESUMES ON THAT PORTION OF THE SITE.

THE PERMITTEE IS REQUIRED TO MEET ALL THE CONDITIONS OF THE 1200C PERMIT. THIS ESCP AND GENERAL CONDITIONS HAVE BEEN DEVELOPED TO FACILITATE COMPLIANCE WITH THE 1200C PERMIT REQUIREMENTS. IN CASES OF DISCREPANCIES OR OMISSIONS, THE 1200C PERMIT REQUIREMENTS SUPERCEDE REQUIREMENTS OF THIS PLAN.

BMP MATRIX FOR CONSTRUCTION PHASES: REFER TO DEQ GUIDANCE MANUAL FOR A COMPREHENSIVE LIST OF AVAILABLE BMP'S.

	CLEARING	MASS GRADING	UTILITY INSTALLATION	STREET CONSTRUCTION	FINAL STABILIZATION	WET WEATHER (OCT. 1-MAY 31ST)
EROSION PREVENTION						
PRESERVE NATURAL VEGETATION	**X	X	X	X	X	X
GROUND COVER					X	X
PLASTIC SHEETING						X
DUST CONTROL	X	X	X	X		X
TEMPORARY/ PERMANENT SEEDING			X		X	
MATTING					X	X
SEDIMENT CONTROL						
SEDIMENT FENCE (PERIMETER)	**X	X	X	X		X
SEDIMENT FENCE (INTERIOR)			X	X		X
BIO BAGS		X	X	X		X
INLET PROTECTION	**X	X	X	X		X
DEWATERING (GENERAL)			X	X		
STRAW MATTING			X	X	X	X
FILTER BERM	X	X	X	X		
RUN-OFF CONTROL						
CONSTRUCTION ENTRANCE	**X	X	X	X		
CHECK DAMS	**X	X	X	X	X	
OUTLET PROTECTION	X	X	X	X		
SURFACE ROUGHENING					X	
POLLUTION PREVENTION						
PROPER SIGNAGE	X	X	X	X	X	X
HAZ WASTE MGMT	X	X	X	X	X	X
SPILL KIT ON-SITE	X	X	X	X	X	X
CONCRETE WASH OUT AREA	X	X	X	X		X

** SIGNIFIES BMP THAT WILL BE INSTALLED PRIOR TO ANY GROUND DISTURBING ACTIVITY.

RATIONALE STATEMENT:

A COMPREHENSIVE LIST OF AVAILABLE BEST MANAGEMENT PRACTICES (BMP) OPTIONS BASED ON DEQ'S GUIDANCE MANUAL HAS BEEN REVIEWED TO COMPLETE THIS EROSION AND SEDIMENT CONTROL PLAN. SOME OF THE ABOVE LISTED BMP'S WERE NOT CHOSEN BECAUSE THEY WERE DETERMINED TO NOT EFFECTIVELY MANAGE EROSION PREVENTION AND SEDIMENT CONTROL FOR THIS PROJECT BASED ON SPECIFIC SITE CONDITIONS, INCLUDING SOIL CONDITIONS TOPOGRAPHIC CONSTRAINTS, ACCESSIBILITY TO THE SITE, AND OTHER RELATED CONDITIONS, AS THE PROJECT PROGRESSES AND THERE IS A NEED TO REVISE THE ESC PLAN, AN ACTION PLAN WILL BE SUBMITTED.

CTF
INITIAL

PERMITTEE'S SITE INSPECTOR: CHRISTIAN FRENCH, CESCL ID# 80062

COMPANY/AGENCY: MURRAYSMITH
PHONE: (971) 357-2176
FAX: (971) 357-2176
E-MAIL: CHRISTIAN.FRENCH@MURRAYSMITH.US
DESCRIPTION OF EXPERIENCE: CESCL TRAINING, AND FIVE YEARS OF EXPERIENCE WITH PREPARATION OF ESC PLANS.

VICINITY MAP

SCALE: 1"=400'

LEGEND

AREA OF PROJECT IMPROVEMENTS

PROJECT LOCATIONS:

SCHEDULE A - TRANSMISSION MAIN - WITHIN OLD AIRPORT ROAD, WESTERLY THEN NORTH ALONG THE CITY'S UGB, AND ALONG AIRPORT ROAD TO NW A AVENUE.

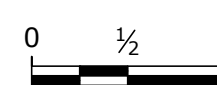
SCHEDULES B & C - RESERVOIR & PUMP STATION - EAST OF OLD AIRPORT ROAD, ONE-HALF MILE NORTH OF HIGHWAY 30.

PROPERTY DESCRIPTIONS:

SCHEDULE A - TRANSMISSION MAIN - WITHIN CITY OF PENDLETON ROADWAYS AND EASEMENTS IN SECTION 5 OF TOWNSHIP 2 NORTH, RANGE 32 EAST.

SCHEDULES B & C - RESERVOIR & PUMP STATION - TAXLOTS 313 AND 320 IN SECTION 5 OF TOWNSHIP 2 NORTH, RANGE 32 EAST.

NOTICE



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**NEW AIRPORT
RESERVOIR &
BOOSTER STATION
PROJECT**

**EROSION & SEDIMENT CONTROL PLAN
COVER SHEET**

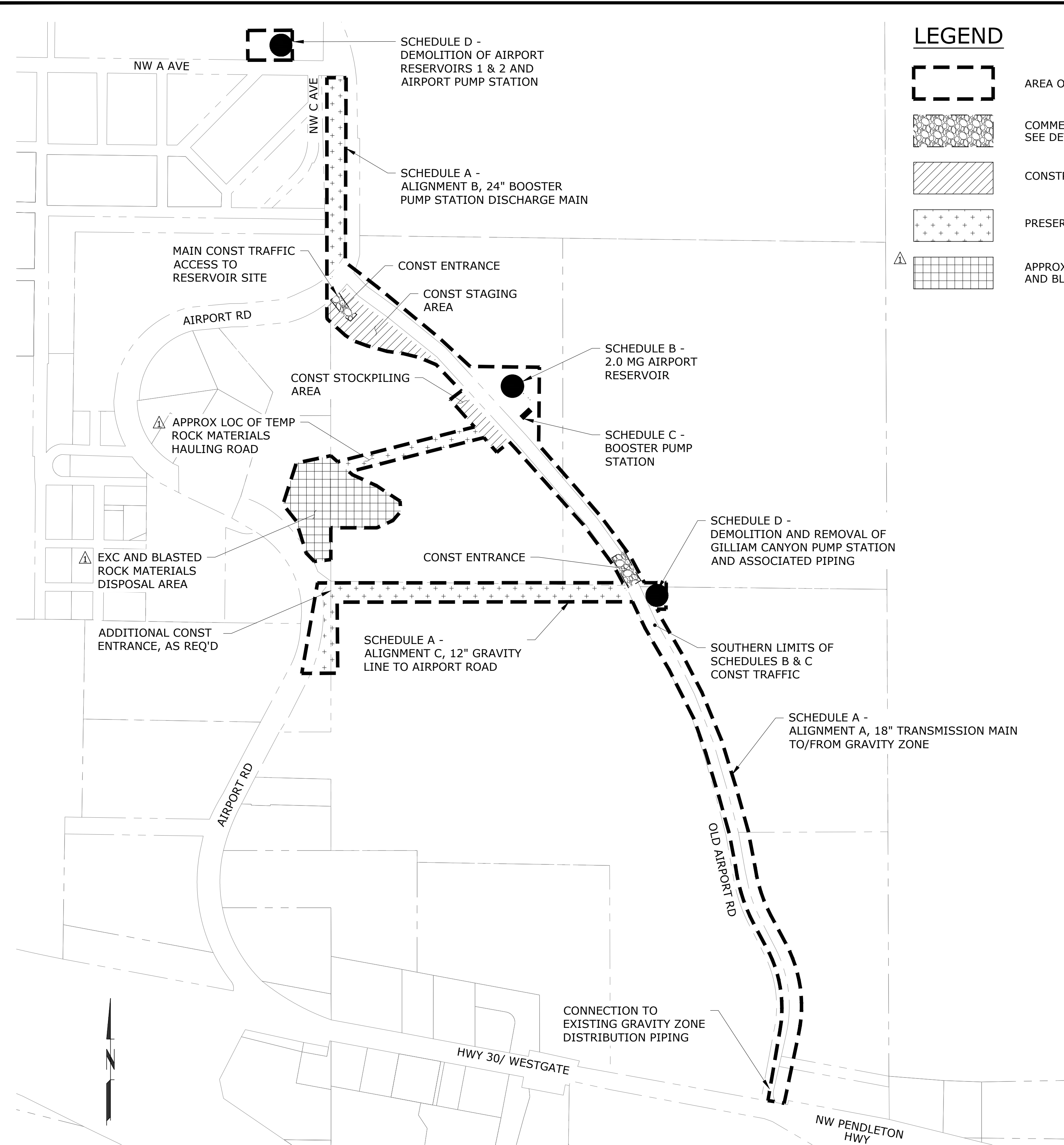
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1	12/02/2021	LLA	ADDENDUM #3

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LEGEND

- AREA OF PROJECT IMPROVEMENTS
- COMMERCIAL CONST ENTRANCE
SEE DET DWG 4-13, SHT ESC-5
- CONSTRUCTION STAGING AND STOCKPILING AREA
- PRESERVE NATURAL VEGETATION AND TEMPORARY SEEDING AREA
- APPROXIMATE LIMITS OF DISPOSAL AREA FOR EXCAVATED AND BLASTED ROCK MATERIALS

EROSION AND SEDIMENT CONTROL BMP IMPLEMENTATION:

1. ALL BASE ESC MEASURES (INLET PROTECTION, PERIMETER SEDIMENT CONTROL, GRAVEL CONSTRUCTION ENTRANCES, ETC). MUST BE IN PLACE, FUNCTIONAL, AND APPROVED IN AN INITIAL INSPECTION, PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.
2. "STOCK PILE AREA" SHALL BE DESIGNATED PRIOR TO EXCAVATION CUT ACTIVITIES. ALL EXCAVATED MATERIALS SHALL BE HAULED OFFSITE.
3. ALL "SEDIMENT BARRIERS (TO BE INSTALLED AFTER GRADING)" SHALL BE INSTALLED IMMEDIATELY FOLLOWING ESTABLISHMENT OF FINISHED GRADE AS SHOWN ON THESE PLANS.
4. LONG TERM SLOPE STABILIZATION MEASURES "INCLUDING SEEDING, JUTE MATTING, WATTLES, AND ROCK CHECK DAMS" SHALL BE IN-PLACE OVER ALL EXPOSED SOILS BY OCTOBER 1.
5. THE STORM WATER FACILITIES SHALL BE CONSTRUCTED AND LANDSCAPED PRIOR TO THE STORM WATER SYSTEM FUNCTIONING AND SITE PAVING.
6. INLET PROTECTION SHALL BE IN-PLACE IMMEDIATELY FOLLOWING PAVING ACTIVITIES.

GRADING, UTILITY EROSION, AND SEDIMENT CONSTRUCTION NOTES:

1. SEED USED FOR TEMPORARY OR PERMANENT SEEDING SHALL BE COMPOSED OF ONE OF THE FOLLOWING MIXTURES, UNLESS OTHERWISE AUTHORIZED:
 - A. VEGETATED CORRIDOR AREAS REQUIRE NATIVE SEED MIXES. SEE RESTORATION PLAN FOR APPROPRIATE SEED MIX.
 - B. DWARF GRASS MIX (MINIMUM 100 LB/AC)
 - i. DWARF PERENNIAL RYEGRASS (80% BY WEIGHT)
 - ii. CREEPING RED FESCUE (20% BY WEIGHT)
 - C. STANDARD HEIGHT GRASS MIX (MINIMUM 100 LB/AC)
 - i. ANNUAL RYEGRASS (40% BY WEIGHT)
 - ii. TURF-TYPE FESCUE (60% BY WEIGHT)
2. SLOPES AND DISTURBED AREA TO RECEIVE TEMPORARY OR PERMANENT SEEDING SHALL HAVE THE SURFACE ROUGHENED BY MEANS OF TRACK-WALKING OR THE USE OF OTHER APPROVED IMPLEMENTS. SURFACE ROUGHENING IMPROVES SEED BEDDING AND REDUCES RUN-OFF VELOCITY.
3. LONG TERM SLOPE AND DISTURBED AREAS STABILIZATION MEASURES SHALL INCLUDE THE ESTABLISHMENT OF PERMANENT VEGETATIVE COVER VIA SEEDING WITH APPROVED MIX AND APPLICATION RATE. SEE SPECIFICATIONS. IN ADDITION, ALL SLOPES OF 2:1 OR GREATER SHALL RECEIVE MATTING.
4. TEMPORARY SLOPE AND DISTURBED AREA STABILIZATION MEASURES SHALL INCLUDE: COVERING EXPOSED SOIL WITH PLASTIC SHEETING, STRAW MULCHING, WOOD CHIPS, OR OTHER APPROVED MEASURES, IN ACCORDANCE WITH SECTION 31 22 13, ROUGH GRADING.
5. STOCKPILED SOIL OR STRIPPINGS SHALL BE HAULED OFFSITE. DURING "WET WEATHER" PERIODS, STOCKPILES SHALL BE COVERED WITH PLASTIC SHEETING OR STRAW MULCH. SEDIMENT FENCE IS REQUIRED AROUND THE PERIMETER OF THE STOCKPILE.
6. EXPOSED CUT OR FILL AREAS SHALL BE STABILIZED THROUGH THE USE OF TEMPORARY SEEDING AND MULCHING, EROSION CONTROL BLANKETS OR MATS, MID-SLOPE SEDIMENT FENCES OR WATTLES, OR OTHER APPROPRIATE MEASURES. SLOPES EXCEEDING 25% MAY REQUIRE ADDITIONAL EROSION CONTROL MEASURES.
7. AREAS SUBJECT TO WIND EROSION SHALL USE APPROPRIATE DUST CONTROL MEASURES INCLUDING THE APPLICATION OF A FINE SPRAY OF WATER, PLASTIC SHEETING, STRAW MULCHING, OR OTHER APPROVED MEASURES.
8. CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES INCLUDING, BUT NOT LIMITED TO, TIRE WASHES, STREET SWEEPING, AND VACUUMING MAY BE REQUIRED TO INSURE THAT ALL PAVED AREAS IN THE VICINITY OF THE SITE USED FOR HAULING SOIL ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.
9. ACTIVE INLETS TO STORM WATER SYSTEMS SHALL BE PROTECTED THROUGH THE USE OF APPROVED INLET PROTECTION MEASURES. ALL INLET PROTECTION MEASURES ARE TO BE REGULARLY INSPECTED AND MAINTAINED AS NEEDED.
10. SATURATED MATERIALS THAT ARE HAULED OFF-SITE MUST BE TRANSPORTED IN WATER-TIGHT TRUCKS TO ELIMINATE SPILLAGE OF SEDIMENT AND SEDIMENT-LADEN WATER.
11. AN AREA SHALL BE PROVIDED FOR THE WASHING OUT OF CONCRETE TRUCKS IN A LOCATION THAT DOES NOT PROVIDE RUN-OFF THAT CAN ENTER THE STORM WATER SYSTEM. IF THE CONCRETE WASH-OUT AREA CAN NOT BE CONSTRUCTED GREATER THAN 50' FROM ANY DISCHARGE POINT, SECONDARY MEASURES SUCH AS BERM OR TEMPORARY SETTLING PITS MAY BE REQUIRED. THE WASH-OUT SHALL BE LOCATED WITHIN SIX FEET OF TRUCK ACCESS AND BE CLEANED WHEN IT REACHES 50% OF THE CAPACITY.
12. SWEEPINGS FROM EXPOSED AGGREGATE CONCRETE SHALL NOT BE TRANSFERRED TO THE STORM WATER SYSTEM. SWEEPINGS SHALL BE PICKED UP AND DISPOSED IN THE TRASH.
13. AVOID PAVING IN WET WEATHER WHEN PAVING CHEMICALS CAN RUN-OFF INTO THE STORM WATER SYSTEM.
14. USE BMPS SUCH AS CHECK-DAMS, BERMS, AND INLET PROTECTION TO PREVENT RUN-OFF FROM REACHING DISCHARGE POINTS.
15. COVER CATCH BASINS, MANHOLES, AND OTHER DISCHARGE POINTS WHEN APPLYING SEAL COAT, TACK COAT, ETC TO PREVENT INTRODUCING THESE MATERIALS TO THE STORM WATER SYSTEM.

PLAN
SCALE: 1"=300'

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1	12/02/2021	LLA	ADDENDUM #3

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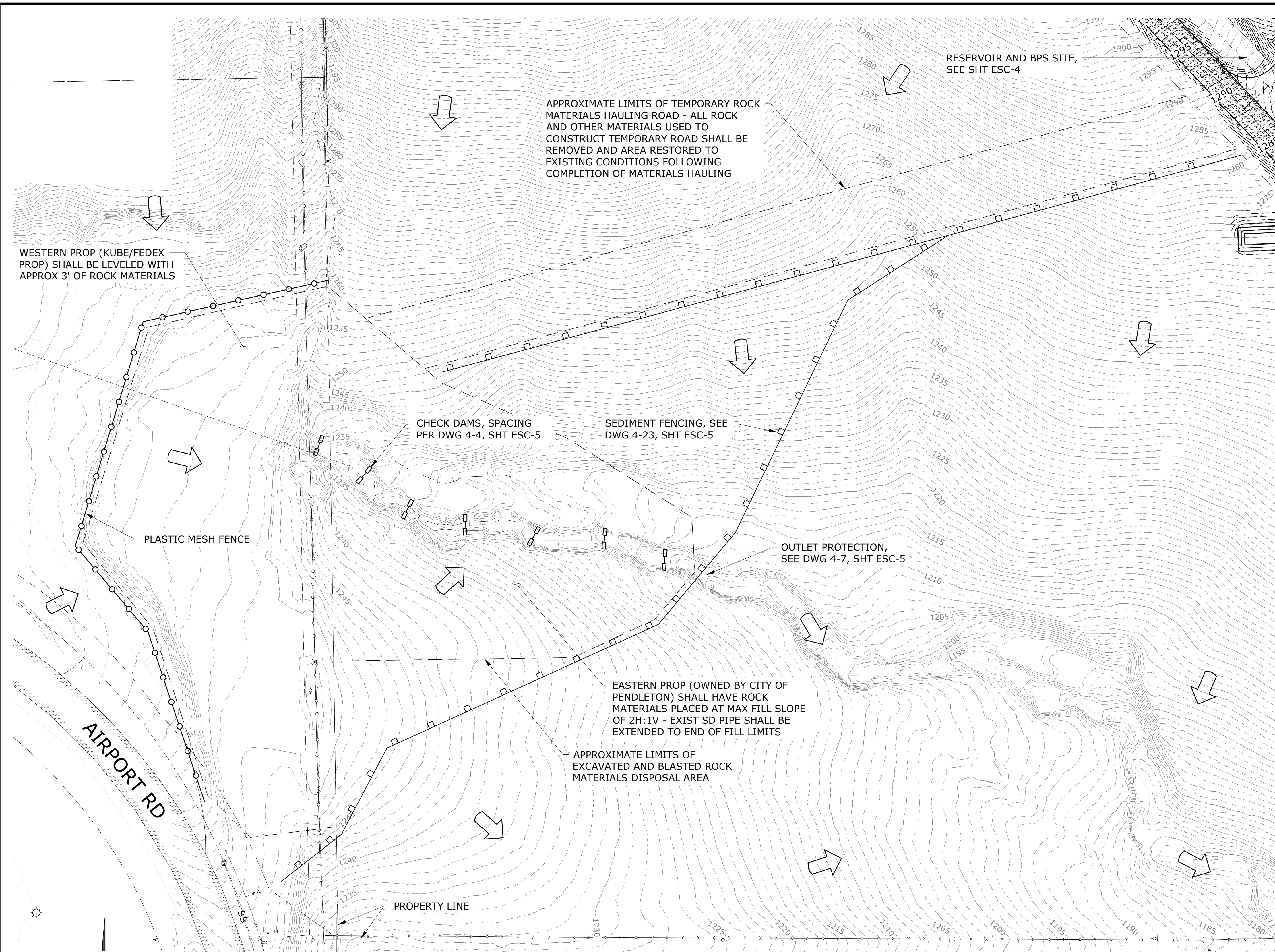
NEW AIRPORT RESERVOIR & BOOSTER STATION PROJECT

**EROSION & SEDIMENT CONTROL PLAN
ESC PLAN OVERVIEW**

PROJECT NO.: 17-2024 SCALE: AS SHOWN DATE: AUGUST 2021

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TYPICAL EROSION CONTROL MEASURES FOR HAULING AND DISPOSAL OF EXCAVATED AND BLASTED ROCK MATERIALS

PLAN
SCALE: 1"=50'

NOTES:

1. SEE ESC-4 FOR EROSION AND SEDIMENT CONTROL BMP IMPLEMENTATION NOTES.
2. SEE ESC-4 FOR GRADING, UTILITY, EROSION, AND SEDIMENT CONSTRUCTION NOTES.

EROSION CONTROL NOTES

- ① EMERGENCY EROSION CONTROL MATERIALS MUST BE KEPT ON SITE AT ALL TIMES.
- ② INSTALL, INSPECT, CLEAN, AND MAINTAIN SEDIMENT FENCE TO PREVENT SEDIMENT LADEN WATER FROM LEAVING THE SITE THROUGHOUT CONSTRUCTION. SEDIMENT FENCE SHALL BE INSTALLED PARALLEL TO SLOPE CONTOURS. ADDITIONAL SEDIMENT FENCE MAY BE REQUIRED BASED ON SITE CONDITIONS AND MEANS AND METHODS DEVELOPED BY CONTRACTOR. OVERLAY SEDIMENT FENCE 6" MINIMUM AND TURN LAST 6 FEET OF FENCE UPSLOPE (TYPICAL).
- ③ INSPECT, CLEAN, AND MAINTAIN GRAVEL CONSTRUCTION ENTRANCE TO PREVENT SEDIMENT AND SEDIMENT LADEN WATER FROM LEAVING THE SITE THROUGHOUT CONSTRUCTION.
- ④ ADDITIONAL TRACKING CONTROL MEASURES SUCH AS A WHEEL WASH MAY BE NECESSARY IF CONSTRUCTION ENTRANCE IS NOT SUFFICIENT.
- ⑤ INSTALL SLOPE MATTING AND PLASTIC SHEETING ON ALL SLOPES 2:1 OR GREATER.
- ⑥ ON-SITE RUNOFF ACCUMULATION INTO LOW POINTS SHALL BE PUMPED BY THE CONTRACTOR TO A SUITABLE LOCATION, IF REQUIRED.

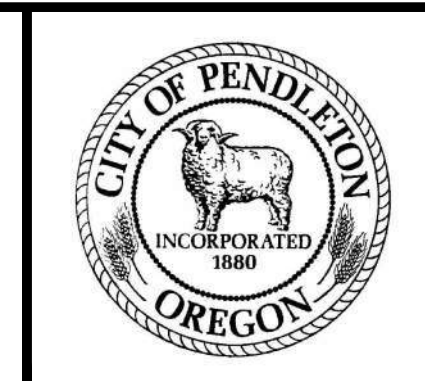
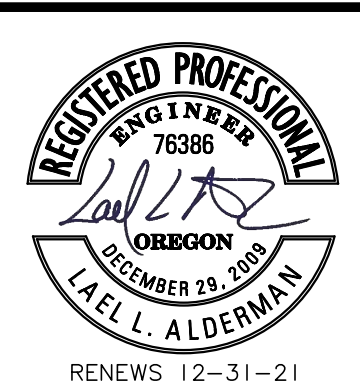
LEGEND

- EXISTING CONTOURS (1') 289
- EXISTING CONTOURS (5') 290
- DRAINAGE FLOW DIRECTION
- SEDIMENT FENCING
- PLASTIC MESH FENCE
- CHECK DAM

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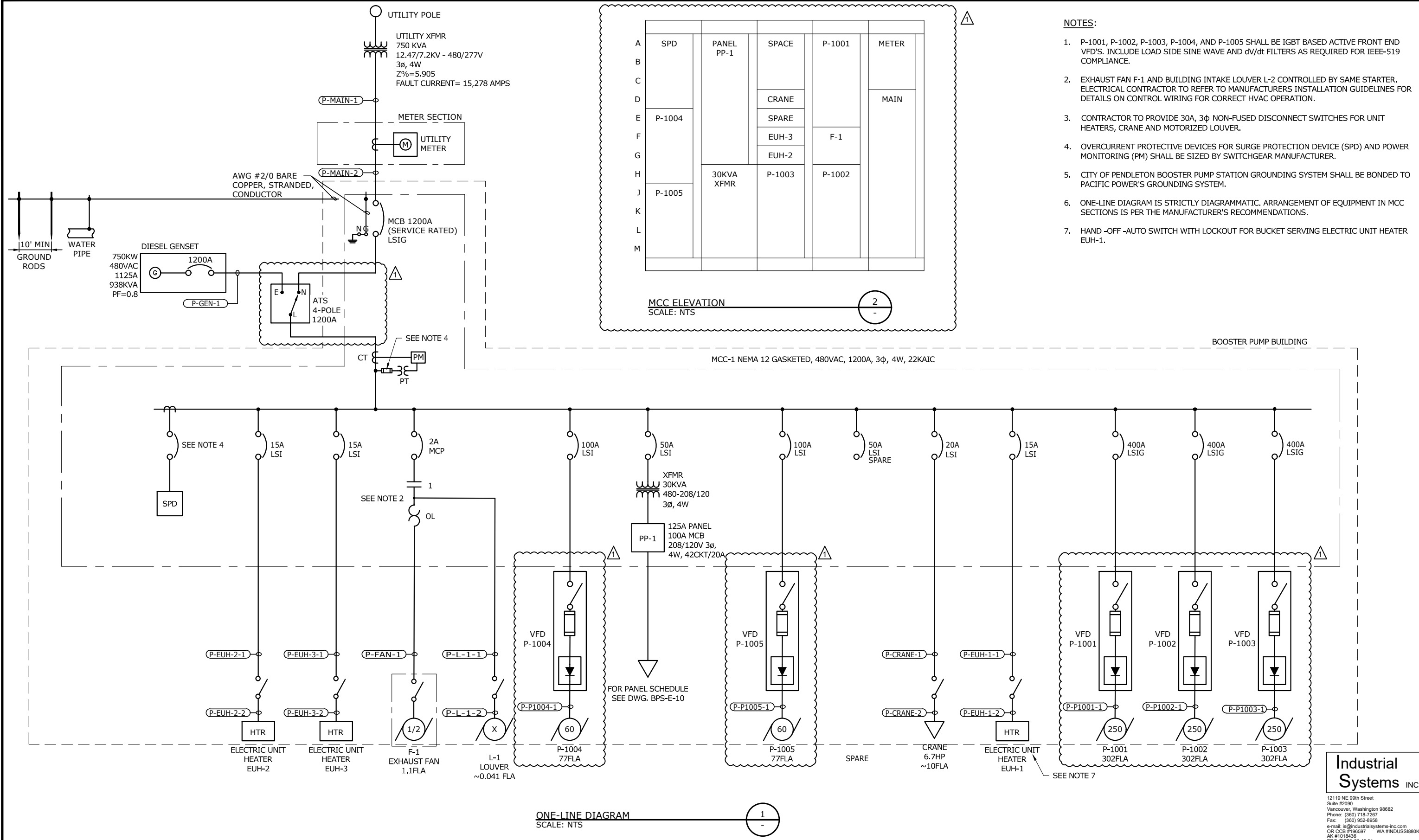
NEW AIRPORT RESERVOIR & BOOSTER STATION PROJECT

EROSION & SEDIMENT CONTROL PLAN
SCHEDULES A & B - EXCAVATED AND BLASTED ROCK MATERIALS DISPOSAL

PROJECT NO.: 17-2024 SCALE: AS SHOWN DATE: AUGUST 2021

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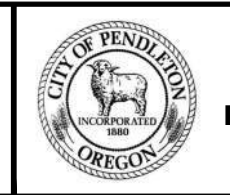
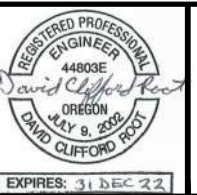


- NOTES:**
- P-1001, P-1002, P-1003, P-1004, AND P-1005 SHALL BE IGBT BASED ACTIVE FRONT END VFD'S. INCLUDE LOAD SIDE SINE WAVE AND dv/dt FILTERS AS REQUIRED FOR IEEE-519 COMPLIANCE.
 - EXHAUST FAN F-1 AND BUILDING INTAKE LOUVER L-2 CONTROLLED BY SAME STARTER. ELECTRICAL CONTRACTOR TO REFER TO MANUFACTURERS INSTALLATION GUIDELINES FOR DETAILS ON CONTROL WIRING FOR CORRECT HVAC OPERATION.
 - CONTRACTOR TO PROVIDE 30A, 3φ NON-FUSED DISCONNECT SWITCHES FOR UNIT HEATERS, CRANE AND MOTORIZED LOUVER.
 - OVERCURRENT PROTECTIVE DEVICES FOR SURGE PROTECTION DEVICE (SPD) AND POWER MONITORING (PM) SHALL BE SIZED BY SWITCHGEAR MANUFACTURER.
 - CITY OF PENDLETON BOOSTER PUMP STATION GROUNDING SYSTEM SHALL BE BONDED TO PACIFIC POWER'S GROUNDING SYSTEM.
 - ONE-LINE DIAGRAM IS STRICTLY DIAGRAMMATIC. ARRANGEMENT OF EQUIPMENT IN MCC SECTIONS IS PER THE MANUFACTURER'S RECOMMENDATIONS.
 - HAND-OFF -AUTO SWITCH WITH LOCKOUT FOR BUCKET SERVING ELECTRIC UNIT HEATER EUH-1.

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1	12/02/21	TBC	ADDENDUM #3

NOTICE
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 JLB DRAWN
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NEW AIRPORT RESERVOIR & BOOSTER STATION PROJECT - SCHEDULE C BOOSTER PUMP STATION

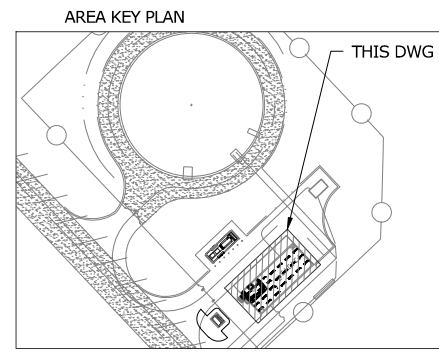
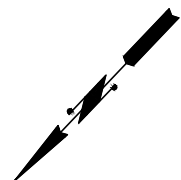
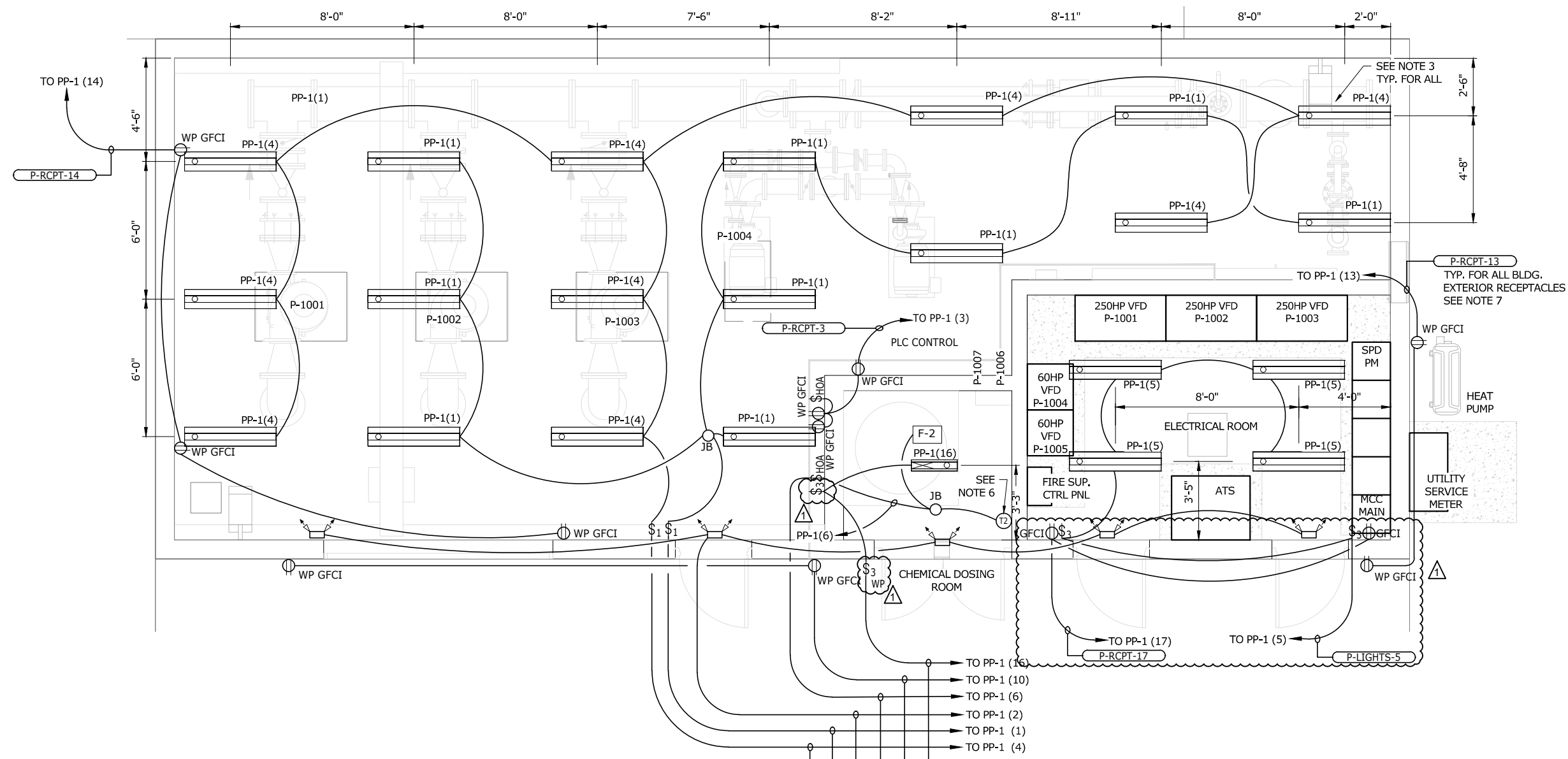
ELECTRICAL ONE LINE DIAGRAM

PROJECT NO.: 17-2024 SCALE: AS SHOWN DATE: MAY 2021

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BPS-E-6
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 AK #1018436
 PROJECT# 20-48-01

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- TO PP-1 (14)
- TO PP-1 (13)
- TO PP-1 (17)
- TO PP-1 (5)
- TO PP-1 (16)
- TO PP-1 (10)
- TO PP-1 (6)
- TO PP-1 (2)
- TO PP-1 (1)
- TO PP-1 (4)

PLAN
SCALE: 3/8"=1'

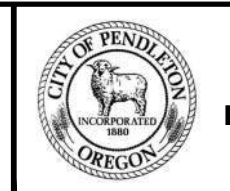
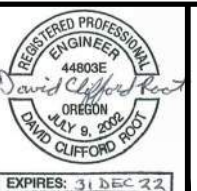
LIGHTING NOTES:

1. FIXTURES IN MAIN PUMP ROOM AREA TO BE CEILING MOUNTED. CONTRACTOR TO CONFIRM MOUNTING HEIGHT DOES NOT INTERFERE WITH EQUIPMENT CRANE OPERATION.
2. FIXTURE LOCATIONS SHOWN ON THIS DRAWING ARE APPROXIMATE. ELECTRICAL CONTRACTOR TO SUPPLY AND INSTALL ALL FIXTURES SHOWN AS CLOSE AS POSSIBLE TO THE INDICATED POSITIONS SHOWN ON THIS PLAN.
3. LIGHTING CIRCUIT DESIGNATION: PP-1, (X) ← PANEL DESIGNATION
← BRANCH CKT. No.
4. FOR DRAWING CLARITY NOT ALL CONDUIT RUNS, CABLING AND CIRCUIT IDENTIFICATIONS ARE SHOWN, REFER TO CABLE SCHEDULES AND PANEL DISTRIBUTION SCHEDULES FOR ADDITIONAL DETAILS.
5. FOR ADDITIONAL SITE LIGHTING SEE DRAWING BPS-E9.
6. ELECTRICAL CONTRACTOR TO WIRE IN-LINE THERMOSTAT (T) INTO HOA SWITCH TO OPERATE EXHAUST FAN F-2. INSTALL SEPARATE SWITCH FOR LIGHT.
7. CONTRACTOR TO INSTALL ALL EXPOSED CONDUITS USING BEST PRACTICES METHOD TO AVOID OBSTRUCTING ACCESS TO SERVICEABLE EQUIPMENT.

NO.	DATE	BY	REVISION
1	12/02/21	TBC	ADDENDUM #3

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NEW AIRPORT RESERVOIR & BOOSTER STATION PROJECT - SCHEDULE C BOOSTER PUMP STATION

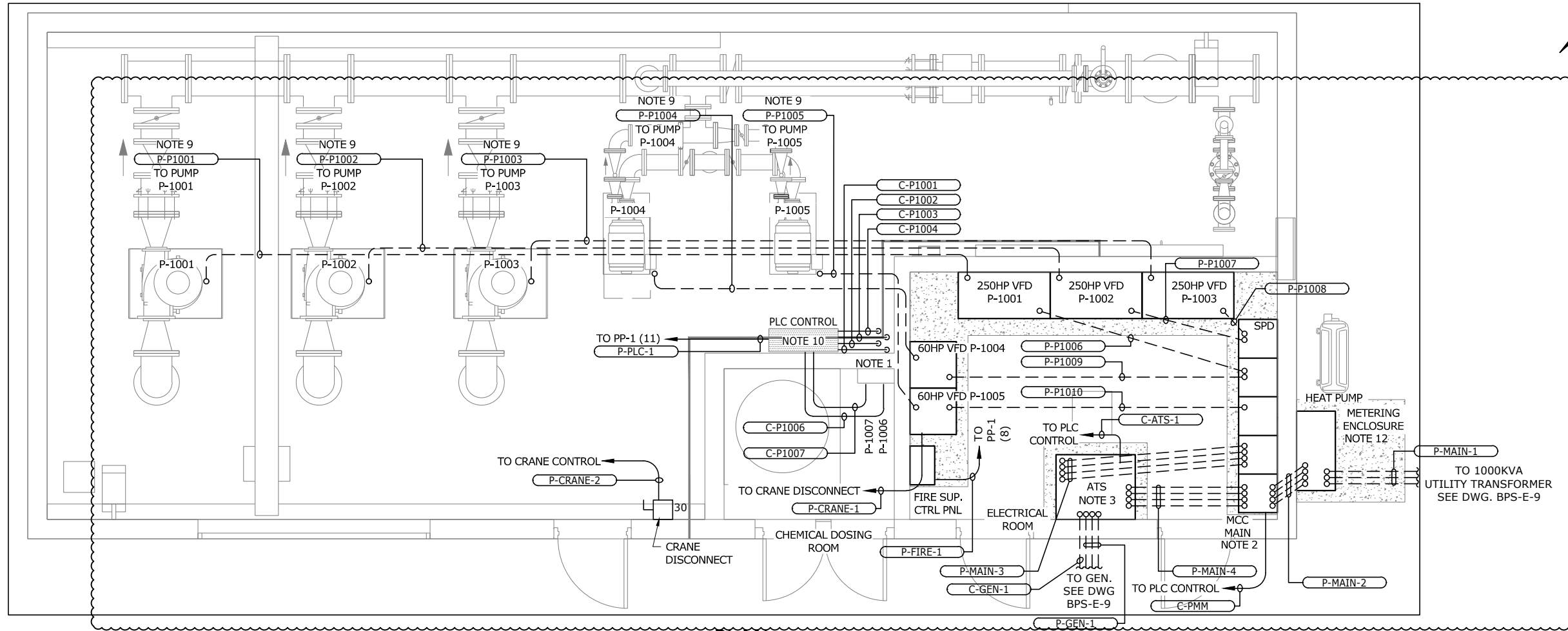
ELECTRICAL LIGHTING

PROJECT NO.: 17-2024 SCALE: AS SHOWN DATE: MAY 2021

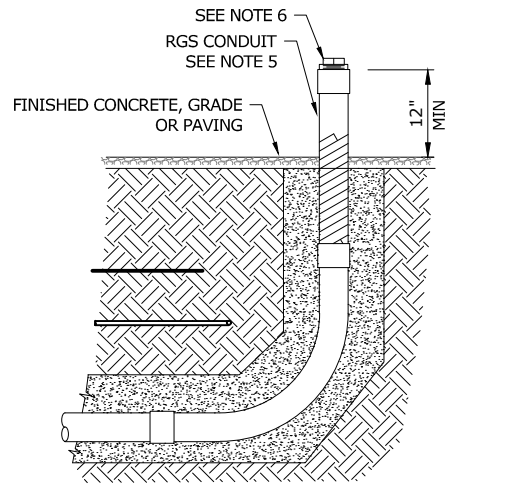
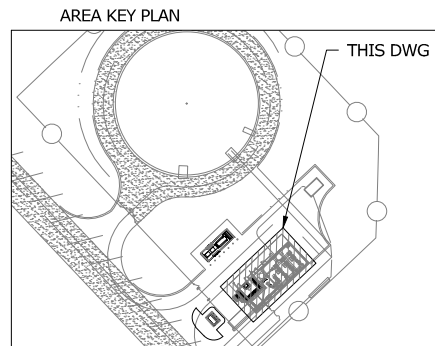
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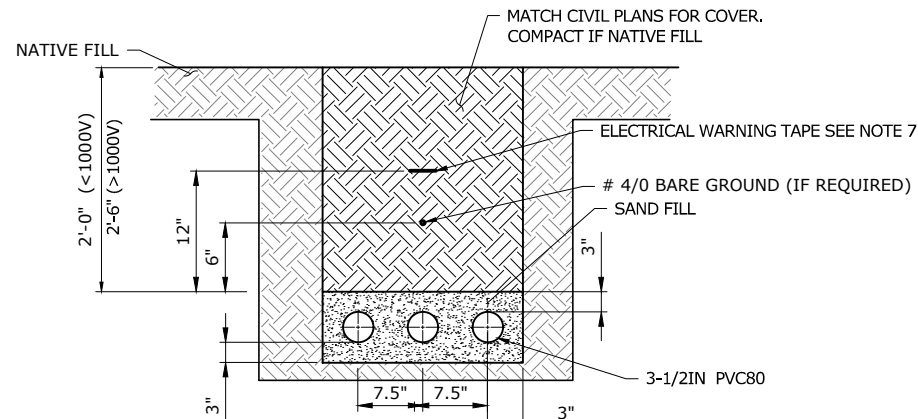
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PLAN
SCALE: 3/8" = 1'-0"



TYPICAL UNDERGROUND CONDUIT STUB UP
SCALE: NTS



SAND FILL DUCT BANK SECTION
SCALE: NTS

NOTES:

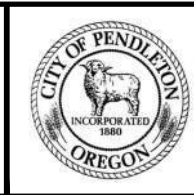
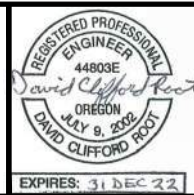
- HYPOCHLORITE PUMPS P-1005 & P-1006 WILL HAVE 120V AC POWER VIA RECEPTACLES INSTALLED INSIDE CHEMICAL ROOM. SEE LIGHTING PLAN DRAWING BPS-E-8.
- BOND NEUTRAL AND GROUND AT MCC MAIN BREAKER.
- AUTOMATIC TRANSFER SWITCH IS 4-POLE SWITCHED NEUTRAL.
- FOR FEEDER BREAKER AND MOTOR STARTER LOCATIONS SEE MCC LAYOUT DRAWING BPS-E-6.
- ANY RGS OR METALLIC CONDUIT COMPONENTS THAT CONTACT EARTH OR CONCRETE SURFACES SHALL BE FULLY WRAPPED WITH PIPE TAPE TO PREVENT EXTERNAL CORROSION.
- INSTALL CONDUIT PLUG ON ALL UNUSED (SPARE) CONDUITS.
- ALL UNDER GROUND CONDUIT DUCT BANKS SHALL HAVE RED WARNING TAPE PLACED INLINE AND 12" MINIMUM ABOVE CONDUITS.
- SEE CONDUIT & CABLE SCHEDULE BPS-E-14 AND BPS-E-15 FOR DETAILED ROUTING INFORMATION.
- POWER CONDUIT FOR PUMP VFD'S ARE TO BE RUN UNDERGROUND FROM WEST WALL OF ELECTRICAL ROOM SEE DETAIL 1.
- PLC CONTROL PANEL SHALL HAVE LABEL IDENTIFYING PANEL IS FED FROM MULTIPLE SOURCES.
- THE ARRANGEMENT OF THE ELECTRICAL EQUIPMENT IN THE ELECTRICAL ROOM HAS CHANGED TO ALIGN WITH THE MANUFACTURERS CHANGES TO DIMENSIONS. THIS WILL IMPACT THE ARRANGEMENT OF EQUIPMENT AND CIRCUITS ON OTHER SHEETS INCLUDED BUT NOT LIMITED TO E-7, E-9, E-12 AND I-1. THE BIDDER IS INSTRUCTED TO INFER THE EQUIPMENT AND CIRCUIT CHANGES SHOWN ON E-10 ONTO OTHER SHEETS AS APPROPRIATE. THESE PLANS ON THESE SHEETS WILL BE UPDATED IN THE CONFORMED DRAWINGS THAT WILL BE ISSUED PRIOR TO BEGINNING CONSTRUCTION.
- PROVIDE EUSERC COMPLAINT METERING ENCLOSURE PER UTILITY REQUIREMENTS.

NO.	DATE	BY	REVISION
1	12/02/21	TBC	ADDENDUM #3

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NEW AIRPORT RESERVOIR & BOOSTER STATION PROJECT - SCHEDULE C BOOSTER PUMP STATION

ELECTRICAL POWER AND CONTROL PLAN

PROJECT NO.: 17-2024 SCALE: AS SHOWN DATE: MAY 2021

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AK #1018436
PROJECT#20_48_01

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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, AND SP - FOR SPARE CONDUCTORS.

CIRCUITS REVISED SINCE LAST ISSUE ARE INDICATED BY AN ASTERISK(*).

CIRCUIT NUMBER	FROM	TO	CONDUCTORS	RACEWAY SIZE (TYPE)	NOTES
P-MAIN-1	PACIFICORP 750KVA UTILITY TRANSFORMER	UTILITY SERVICE METER	PULL CORD	(4) 4" (PVC 80)	POWER CONDUCTORS PROVIDED BY UTILITY
P-MAIN-2	UTILITY SERVICE METER	MCC MAIN INCOMING 1200A BREAKER	(12) #500 KCMIL, P (4) #500 KCMIL, N	(4) 3-1/2" (RGS)	TYPE XHHW CONDUCTORS
P-MAIN-3	MCC MAIN INCOMING 1200 BREAKER	ATS SECTION	(12) #500 KCMIL, P (4) #500 KCMIL, N	(4) 3-1/2" (RGS)	TYPE XHHW CONDUCTORS
P-MAIN-4	ATS SECTION	MCC - 1	(9) #600 KCMIL, P (3) #600 KCMIL, N (3) #3/0 GND	(3) 3-1/2" (PVC 80)	TYPE XHHW CONDUCTORS
P-GEN-1	750KW GENERATOR MAIN BREAKER	MCC ATS SECTION	(9) #600 KCMIL, P (3) #600 KCMIL, N (3) #3/0 GND	(3) 3-1/2" (PVC 80)	TYPE XHHW CONDUCTORS
P-P1001	250HP VFD SECTION P-1001	250HP PUMP P-1001	(3) #500KCMIL, P (1) #6 GND	4" (PVC 40)	VFD CABLE, SHIELDED
P-P1002	250HP VFD SECTION P-1002	250HP PUMP P-1002	(3) #500KCMIL, P (1) #6 GND	4" (PVC 40)	VFD CABLE, SHIELDED
P-P1003	50HP VFD SECTION P-1003	250HP PUMP P-1003	(3) #500KCMIL, P (1) #6 GND	4" (PVC 40)	VFD CABLE, SHIELDED
P-P1004	60HP VFD SECTION P-1004	60HP PUMP P-1004	(3) #2 AWG, P (1) #10 GND	2" (PVC 40)	VFD CABLE, SHIELDED
P-P1005	60HP VFD SECTION P-1005	60HP PUMP P-1005	(3) #2 AWG, P (1) #10 GND	2" (PVC 40)	VFD CABLE, SHIELDED
P-P1006	MCC - 1 400A BREAKER	250HP VFD SECTION P-1001	(3) #500KCMIL, P (1) #6 GND	4" (PVC 40)	TYPE XHHW CONDUCTORS
P-P1007	MCC - 1 400A BREAKER	250HP VFD SECTION P-1002	(3) #500KCMIL, P (1) #6 GND	4" (PVC 40)	TYPE XHHW CONDUCTORS
P-P1008	MCC - 1 400A BREAKER	50HP VFD SECTION P-1003	(3) #500KCMIL, P (1) #6 GND	4" (PVC 40)	TYPE XHHW CONDUCTORS
P-P1009	MCC - 1 60A BREAKER	60HP VFD SECTION P-1004	(3) #2 AWG, P (1) #10 GND	2" (PVC 40)	TYPE XHHW CONDUCTORS
P-P1010	MCC - 1 60A BREAKER	60HP VFD SECTION P-1005	(3) #2 AWG, P (1) #10 GND	2" (PVC 40)	TYPE XHHW CONDUCTORS
P-CRANE-1	MCC - 2 20A BREAKER	CRANE NON-FUSED DISCONNECT PANEL	(3) #10 AWG, P (1) #12 GND	3/4" (RGS)	
P-CRANE-2	CRANE NON-FUSED DISCONNECT PANEL	EQ CRANE CONTROL FIELD VERIFY LOCATION	(3) #10 AWG, P (1) #12 GND	3/4" (RGS)	
P-FAN-1	MCC - 3 SIZE 1 FVNR STARTER	HVAC EXHAUST FAN F-1	(3) #12 AWG, P (1) #12 GND	3/4" (PVC 40)	
P-EUH-2-1	MCC - 3 15A BREAKER	EUH2 3 PHASE NON-FUSED DISCONNECT	(3) #12 AWG, P (1) #12 GND	3/4" (RGS)	
P-EUH-2-2	EUH-2 3 PHASE NON-FUSED DISCONNECT	EUH2 3 PHASE HEATER	(3) #12 AWG, P (1) #12 GND	3/4" (RGS)	
P-EUH-3-1	MCC - 3 15A BREAKER	EUH3 3 PHASE NON-FUSED DISCONNECT	(3) #12 AWG, P (1) #12 GND	3/4" (RGS)	
P-EUH-3-2	EUH-3 3 PHASE NON-FUSED DISCONNECT	EUH3 3 PHASE HEATER	(3) #12 AWG, P (1) #12 GND	3/4" (RGS)	

P-L-1-1	MCC - 3 SIZE 1 FVNR STARTER FOR EXHAUST FAN F-1	LOUVER L-1 NON-FUSED DISCONNECT	(3) #12 AWG, P (1) #12 GND	3/4" (RGS)	
P-L-1-2	LOUVER L-1 NON-FUSED DISCONNECT	LOUVER L-1	(3) #12 AWG, P (1) #12 GND	3/4" (RGS)	
P-HP1-1	DISTRIBUTION PANEL PP-1 CKT 7,9	HEAT PUMP HP-1 FUSED DISCONNECT	(3) #8 AWG, P (1) #10 GND	1" (RGS)	
P-HP1-2	HEAT PUMP HP-1 FUSED DISCONNECT	HEAT PUMP HP-1	(3) #8 AWG, P (1) #10 GND	1" (RGS)	
P-LIGHTS-1	DISTRIBUTION PANEL PP-1 CKT 1	BOOSTER PUMP BUILDING LIGHTING	(1) #12 AWG, P (1) #12 AWG, N (1) #12 AWG, GND	3/4" (RGS)	
P-LIGHTS-2	DISTRIBUTION PANEL PP-1 CKT 2	BOOSTER PUMP BUILDING EMERGENCY LIGHTING	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-RCPT-3	DISTRIBUTION PANEL PP-1 CKT 3	CHEMICAL ROOM DUPLEX RECEPTACLES	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-LIGHTS-4	DISTRIBUTION PANEL PP-1 CKT 4	BOOSTER PUMP BUILDING LIGHTING	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-LIGHTS-5	DISTRIBUTION PANEL PP-1 CKT 5	ELECTRICAL ROOM LIGHTS	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-LIGHTS-6	DISTRIBUTION PANEL PP-1 CKT 6	CHEMICAL ROOM LIGHTING & EXHAUST FAN	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-RCPT-10	DISTRIBUTION PANEL PP-1 CKT 10	BOOSTER PUMP BUILDING EXTERIOR BUILDING RECEPTACLES	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-GEN-2	DISTRIBUTION PANEL PP-1 CKT 12	750KW GENERATOR CONTROL PANEL BATTERY CHARGER	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	1" (PVC 80)	
P-RCPT-13	DISTRIBUTION PANEL PP-1 CKT 13	BOOSTER PUMP BUILDING EXTERIOR BUILDING RECEPTACLES	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-LIGHTS-15	DISTRIBUTION PANEL PP-1 CKT 15	BOOSTER PUMP BUILDING EXTERIOR BUILDING LIGHTS	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-PLC-1	DISTRIBUTION PANEL PP-1 CKT 11	PLC CONTROL CABINET	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-RCPT-14	DISTRIBUTION PANEL PP-1 CKT 14	BOOSTER PUMP BUILDING RECEPTACLES SOUTH & EAST WALL	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-FG-1	DISTRIBUTION PANEL PP-1 CKT 20,22	FENCE GATE ACTUATOR	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	1" (PVC 40)	
P-RCPT-17	DISTRIBUTION PANEL PP-1 CKT 17	ELECTRICAL ROOM RECEPTACLES	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-MOV-102-1	DISTRIBUTION PANEL PP-1 CKT 19	MOV-102 POWER NON-FUSED DISCONNECT SWITCH	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-MOV-102-2	MOV-102 POWER NON-FUSED DISCONNECT SWITCH	ELECTRICAL ACTUATED VALVE V-102	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-RCPT-18	DISTRIBUTION PANEL PP-1 CKT 18	WATER TANK RECEPTACLES	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	
P-GEN-3	DISTRIBUTION PANEL PP-1 CKT 21/23	750KW GENERATOR BLOCK HEATER TERMINAL BOX	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	1" (PVC 80)	
P-FIRE-1	DISTRIBUTION PANEL PP-1 CKT 21/23	FIRE SUPPRESSION CONTROL PANEL	(1) #12 AWG, P (1) #12 AWG, N (1) #12_GND	3/4" (RGS)	

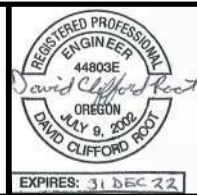
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NEW AIRPORT RESERVOIR & BOOSTER STATION PROJECT - SCHEDULE C BOOSTER PUMP STATION

ELECTRICAL CABLE SCHEDULE - 1

PROJECT NO.: 17-2024 SCALE: AS SHOWN DATE: MAY 2021

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