SPECIFICATIONS
For
PRODUCTION WELL OF THE GROUNDWATER OPEN LOOP GEO-EXCHANGE SYSTEM

for

Oregon State University – Cascades
Bend, Oregon

Prepared by:
Introba

PROJECT NO: 2010.0002458.002

ISSUED FOR TENDER

ISSUE DATE: January 23, 2025

1. GENERAL

1.1 Scope of Work

Oregon State University (OSU) is looking to improve the redundancy of it's open loop geo-exchange system by installing a second, standby production well at Cascades campus in Bend, Oregon.

The scope of work under this contract will include:
1. Installation of a groundwater (GW) production well, including pit-less adapter,
2. Conducting a production well pump test to confirm the design flow rate of 1,075 GPM, and
3. Purchase and installation of a new submersible pump inside the new production well.

Additional scope that could be included at the Owner's discretion
1. Temporary power for pump testing

1.2 Contractor Qualifications and Responsibilities

1. Within this scope and specifications, the term Contractor refers to a qualified and experienced well drilling contractor, geo-exchange installation contractor, GW pump test, and any additional required subtrades. The contractor can retain other adequately qualified and experienced subtrades for the portions of the scope for which the subtrades are better qualified. However, the contractor shall carry full responsibility for completing the entire scope under this contract.

2. The contractor including all his subtrades shall demonstrate that they are fully qualified and licensed in the state of Oregon, and that they have completed projects of comparable scope and complexity.

3. The Contractor shall be responsible for all permits required to complete the scope under this contract and for following all applicable local, state and federal codes and regulations. When discrepancy exists between local codes and regulations and this specification, the more stringent of the two documents prevail.

4. The contractor shall provide all necessary materials, equipment, labor, supervision, and perform all work and fulfill all requirements under this scope as set forth in accordance with these specifications

5. The contractor shall be familiar with the latest version of the ANSI/ CSA/ IGHSPA C448 Series 16 Standard; Design and installation of ground source heat pump systems for commercial and residential buildings (a bi-national standard by Canada and the US) and assure that all work carried out under this scope will be done in accordance with the guidelines outlined in this standard.
6. The Contractor shall take all necessary precautions to protect the site from any damage resulting from the drilling operation including a pre-investigation check for underground services.

7. The Contractor shall provide water and all temporary power and fuel to site for drilling operations.

8. The Contractor shall remove all cutting, slurry, and groundwater from site.

2. WELL DRILLING

1. No particular type of drilling method is specified. However, the selected drilling method must be capable of effectively drilling the GW well in the anticipated regional geology and drilling conditions to complete the drilling in a timely, efficient, and cost-effective manner.

2. The contractor shall construct the GW well in such a manner so as to achieve sufficient well wall stability to allow insertion of the GW intake screen (if required), and grout tremie pipe to the full target depth of the borehole.

3. Stainless steel surface casing may be required to stabilize and seal the upper portion of the drill hole where unconsolidated soils are encountered. This is intended to prevent cave-in of the upper borehole before the GW well is completed. The 304 stainless steel casing shall be sealed through upper unconsolidated strata as per all applicable regulations.

4. The Contractor shall use drilling fluids that minimize mud-cake buildup on the borehole wall to avoid plugging up groundwater bearing fracture zones. Drilling fluids could use mud thinners or dispersants to minimize mud intrusion into fractures.

5. The contractor shall be responsible for drill cuttings and groundwater control and management on the site, and for removal of the cutting's material and groundwater from the project site and disposing of it elsewhere in an environmentally safe manner.

6. Any groundwater used or generated in the drilling operation will be disposed in a manner which safeguards equipment and other assets and protects the health and safety of all workers and passers-by. The contractor shall provide a sediment control plan detailing all measures as it fits within the overall site's sediment control plan.

7. The contractor shall comply with the applicable Ground Water Protections Regulations in the event of encountering artesian flow.

8. Berms shall be used to prevent water flowing into streams or sewers

9. Groundwater used or generated in the drilling operation should be collected by means of a vac-truck or dispersed back to ground if the site permits

3. DRILLER'S LOGS, RECORDS AND REPORTS

1. Drilling Contractor shall provide a detailed report documenting the GW well drilling, which is to include the following information:

    1. Each formation type encountered during well drilling (drill log)
    2. Each formation depth (in feet)
    3. Depth of any significant cracks, fissures or caverns encountered
    4. All water bearing zones and if encountered:
        1. Zone depths
        2. Estimated flow rate
    5. Type of drilling equipment used (i.e. mud-rotary, air-rotary, air-hammer, etc.), and rig model number
    6. Bag quantity of drill mud used if applicable
    7. Total time to drill the GW well excluding shut-downs to obtain water or mechanical break-downs. A completed, signed report shall be supplied immediately at the conclusion of the drilling process.
    8. Collect soil/rock samples to create a Well Log.
    9. Identify features that may affect the performance or layout of ground loop, ease of drilling and depth of ground work.
    10. Provide a conclusion and recommendation based on findings.

4. PROVISION OF TEMPORARY POWER

1. Permanent power may or may not be available for the pump startup, testing, etc. The contractor shall provide separate pricing to provide temporary power to the submersible pump for the pump startup and commissioning and production well pump test in the event onsite power is not available.

2. Upon completion of the production well pump test scope, the contractor is to ensure submersible pump power connection is terminated in the pitless adapter junction box and ready for final connection.

5. PRODUCTION WELL INSTALLATION, DEVELOPMENT AND GROUNDWATER TEST

1. The GW test scope outlined below will involve installing, developing and conducting a pump test for one GW production well.

2. The GW test will include drilling of a single 12" diameter, 500ft deep well at a selected location which will be used to confirm presence and depth of groundwater aquifer, and to conduct groundwater pump test to confirm available groundwater yield (targeting 1,075 GPM of sustained yield), as well as to collect groundwater sample for chemical and bacterial analysis.

3. The well for GW test shall be installed, fitted with adequately sized GW intake screen (if required based on the encountered geology) and developed as per applicable regulations and any additional requirements needed to complete before commencing the GW test outlined below.

4. The production well development is intended to ensure that only clean GW is used by the OSU open loop system. As a minimum, the well development shall consist of pumping the GW at a continuous design flow rate of 1,075 GPM for a minimum of 2 hours. The GW shall be safely discharged to the designated location on site. The driller should plan that the discharge location may be up to 1200 ft away and they should plan on covering the cost of that conveyance.

5. After the well is installed and developed, let the groundwater level (GWL) settle for at least 24 hrs before taking initial GW static level measurements.

6. Install temporary submersible or inline shaft pump to conduct GW test

7. Set up safe GW discharge in compliance with all regulations to a suitable storm catch basin. Make sure the storm sewer will be able to accommodate the tested flow discharge

8. Set up a flowmeter and orifice weir to measure the GW flowrate.

9. Conduct the GW step-drawdown pumping test in at least 3 pumping rate steps. Increase/ adjust the pumping rate incrementally to determine appropriate flow. Each step shall involve constant pumping rate for at least 15 mins, or until a steady-state condition is reached (when no increase in GWL drawdown is recorded over time). Assure the steady state pumping rate is maximized while the maximum allowable GWL drawdown, to the top of the submersible pump, is not exceeded.

10. Once the appropriate pumping rate has been determined, allow 2.5 hours for aquifer GWL to return to equilibrium conditions.

11. Continue with the constant pumping corresponding to steady-state conditions for at least 2 hours.

12. Stop the pump and conduct GWL recovery test to monitor the rate at which the GWL recovers. Monitoring shall continue until the GLW is back to the pre-pumping static level.

13. The contractor shall install the production well-surface seal in accordance with Oregon Water Resources Department regulations.

6. WELL CASING AND SCREEN

1. Supply and install 304 stainless steel 12" diameter well casing extending into the bedrock.

2. Supply and install 304 stainless steel 12" diameter telescoping well screen extending from the bottom of the

well casing to the bottom of the well.

3. Refer to the hydrogeologist well drawing (Appendix A) for initial well casing installation depth, the well screen installation depth and the well screen slot diameter requirements. Final depths to be confirmed by hydrogeologist drill log.

7. PITLESS ADAPTER SPECIFICATION

1. Supply and install pitless adapter at the top of the new 12" production well 304 stainless steel casings. The pitless adapter shall be constructed from 304 stainless steel. The use of any low-carbon steel/ferrous components as part of the pitless adapter assembly will not be acceptable. Refer to the Equipment schedule in Section 11.

2. The contractor shall submit shop drawings for the pitless adapter including the manufacturer and model of the pitless unit to be installed with detailed specifications and drawings of the unit to be installed.

3. The pitless adapter is to be provided with the following:
    1. Stainless steel inserts used at critical "O" ring seal and spool seat surfaces
    2. Water tight, heavy duty stainless steel cap
    3. Stainless steel screened well vent
    4. Neoprene cap gasket
    5. Upper casing barrel to extend the well head at least 24" above ground supplied by factory or installer.
    6. Weld-on discharge; 6" flanged connection to be provided.
    7. Two (2), oblong shaped, 3" ID x 1.25" ID stainless steel access channels for pump controls wiring and ground water level monitoring.
    8. An airline (PE pipe with diameter that will fit through the pitless adapter access channel) extending to at least 20ft below the SWL to deploy transducers for water level monitoring
    9. Weld-on connection 304 stainless steel well casing with cap with pressure fitted port, electrical junction box and all required accessories to make a complete and operational well meeting all regulatory requirements
4. Follow all recommendations in pitless adapter manufacturer's installation instructions.

5. Pitless adapter is to be installed with the 6" dia flanged horizontal discharge pipe connection 5 ft below grade to ensure the horizontal piping is installed below frost line.

6. The well casing cap to be welded on top of the pitless adapter shall extend to at least 24" above the ground surface as per OWRD requirements. The horizontal connection shall be sealed with a blank flange until the permanent horizontal piping gets connected (by others) to the pitless adapter.

8. SUBMERSIBLE WELL PUMP SPECIFICATION

1. Supply and install submersible vertical turbine well pump and accessories capable of delivering a minimum of 550 gpm at 435 ft of head in the new GW production well. The pump shall be constructed from 304 stainless steel. The use of any low-carbon steel/ ferrous components as part of the pump assembly will not be acceptable. The pump diameter shall fit inside a 12" diameter well casing while pumping the target design flow. Refer to Equipment schedule in section 11.

2. Submersible pump installation to be complete with a 6" 304 stainless steel drop pipe connecting the pitless adaptor to the GW pump.

3. The contractor shall submit shop drawings for the submersible pump including the manufacturer and model of the pump to be installed with detailed specifications and shop drawings including certified pump curves showing

pump performance characteristics with pump and system operating points plotted. Include pump curves at 10% speed increment between 100% and 50 % pumps speed (60Hz – 30Hz) and NPSH curves when applicable. Show pump weights, motor and pump operating or efficiencies and electrical power characteristics.

4. The pump motors shall be high efficiency and/or inverter only and shall be suitable for variable speed operation and compatible with variable frequency drives.

5. Check and align pump prior to start-up or commissioning.

6. Follow all recommendations in manufacturer's installation instructions.

7. Pump to be set at the top of the well screen (approximately 400' below ground surface). Final static water level and pump setting depth to be confirmed during pump test by hydrogeologist. Obtain approval from Introba prior to pump installation.

8. Use start-up services of pump, motor and VFD manufacturers.

9. The variable speed of the submersible pump motor shall NOT be lowered below the minimum motor speed recommended by pump motor & VFD manufacturers in order to protect the motor from overheating and to comply with the motor manufacturer's warranty requirements. At all times, the controls must be set to ensure that well pumps cannot be operated at speeds below which flow ceases.

10. During testing, each pump shall be operated at each allowable/feasible frequency above 30 Hz, in increments of 1 Hz, for a period of no less than 3 minutes at each frequency.

11. During the production well test the pump shall be manually controlled as described in Section 5.

9. VARIABLE FREQUENCY DRIVE SPECIFICATION

PART 1 - GENERAL

9.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

9.2 SUMMARY

1. This specification is to cover a complete Variable Frequency Drive (VFD aka: VFD, AFD, ASD, Inverter, AC Drive, et al) consisting of a pulse width modulated (PWM) inverter designed for use with a standard AC induction motor, synchronous reluctance (SynRM) and permanent magnet (PM) motors in water and wastewater applications. The VFD must provide a V/Hz or sensor-less vector mode of operation.
2. The drive manufacturer shall supply the drive and all necessary options as specified. VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable. All VFDs installed on this project shall be from the same manufacturer.
3. VFD to be complete with reactance input filter and sinewave output filter. Refer to drawing M-02 for equipment schedule.
4. Related Sections:
    1. Section 20 00 00 "Common Motor Requirements for MECHANICAL Equipment".
    2. Division 26 for monitoring and control of motor circuits.

9.3 DEFINITIONS

1. ASD: Adjustable Speed Drive.
2. BAS: Building automation system.
3. DDC: Direct digital control.
4. EMI: Electromagnetic interference.
5. IGBT: Insulated-gate bipolar transistor.
6. LAN: Local area network.
7. LED: Light-emitting diode.

8. OCPD: Overcurrent protective device.
9. PID: Control action, proportional plus integral plus derivative.
10. PWM: Pulse-width modulated.
11. RFI: Radio-frequency interference.
12. VFC: Variable frequency controller.
13. VFD: Variable frequency drive.

9.4 ACTION SUBMITTALS

1. See Division 01 and Section 20 00 00 "General Mechanical Requirements" for submittal procedures. Also may be submitted as Variable-Frequency Controller (VFC), Adjustable Speed Drive (ASD), or similar.
2. Product Data: For each type and rating of VFD indicated.
    1. Include dimensions and finishes.
    2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
    3. Include short circuit interrupting capacities in compliance with Division 26.
    4. Include electrical power monitoring information in compliance with Division 26.
3. Shop Drawings: For each VFD indicated.
    1. Include mounting and attachment details.
    2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    3. Include diagrams for power, signal, and control wiring.
    4. Include certification that VFD selection has been coordinated with equipment being served.
    5. Include ventilation means, points of connection, and air path.
    6. Include confirmation of reactance input filter and sinewave output filter.

9.5 INFORMATIONAL SUBMITTALS

1. Qualification Data: For testing agency.
2. Seismic Qualification Certificates: For each VFD, accessories, and components, from manufacturer.
    1. Certificate of compliance.
    2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
    3. Detailed description of equipment anchorage devices on which the certification is based, and their installation requirements.
3. Product Certificates: For each VFD from manufacturer.
4. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.
5. Source quality-control reports.
6. Field quality-control reports.
7. Sample Warranty: For special warranty.

9.6 CLOSEOUT SUBMITTALS

1. Operation and Maintenance Data: For VFDs to include in emergency, operation, and maintenance manuals.
    1. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:
        1. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
        2. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
        3. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
        4. Routine maintenance requirements for VFDs and all installed components.
        5. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
        6. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit

actual motors to be protected.

9.7 MAINTENANCE MATERIAL SUBMITTALS

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
    2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
    3. Indicating Lights: Two of each type and color installed.
    4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
    5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

9.8 QUALITY ASSURANCE

1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
2. Source Limitations: Obtain VFDs of a single type through one source from a single manufacturer.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
4. Referenced Standards and Guidelines:
    1. Institute of Electrical and Electronic Engineers (IEEE)
        a. IEEE 519, Guide for Harmonic Content and Control.
    2. Underwriters Laboratories (as appropriate)
        a. UL508C
        b. UL61800-5-1
    3. National Electrical Manufacturer's Association (NEMA)
        a. ICS 7.0, AC Adjustable Speed Drives
    4. International Electro-technical Commission (IEC)
        a. EN/IEC 61800-3
        b. 2014/35/EU Low Voltage Directive
        c. 2014/30/EU Electromagnetic compatibility (EMC)
        d. 2006/42/EC Machinery Directive
    5. National Electric Code (NEC)
        a. NEC 430.120, Adjustable-Speed Drive Systems
    6. International Building Code (IBC)
        a. IBC 2012 Seismic – referencing ASC 7-05 and ICC AC-156
5. Qualifications:
    1. VFDs and options shall be UL508C listed. The ACQ580 standard VFD shall be UL labeled 100 kA SCCR, RMS Symmetrical, 600V max.
    2. UL-APPROVAL the VFDs shall be available as UL compliant version which complies the technical regulations of UL according to UL61800-5-1. A UL listing document shall be available to confirm VFDs compliance with the requirements. Manufacturer's statements of UL compliance or pending approval are not accepted. The VFD shall comply the technical regulations of UL according to UL508C. UL listing document shall be available to confirm VFDs compliance with the requirements.
    3. Environmental Manufacturing: The VFD shall comply with Restriction of Hazardous Substances in Electrical and Electronic Equipment directive 2011/65/EU requirements, so called RoHS II requirements. The VFD shall be easy to recycle. The manufacturer shall make recycling instructions publicly available. The recycling instructions shall provide recycling information in accordance to Waste Electrical and Electronic Equipment directive 2012/19/EU (WEEE)
6. Environmental Manufacturing: The VFD shall comply with Restriction of Hazardous Substances in Electrical and Electronic Equipment directive 2011/65/EU requirements, so called RoHS II requirements. The VFD shall be easy to recycle. The manufacturer shall make recycling instructions publicly available. The recycling instructions shall provide recycling information in accordance to Waste Electrical and Electronic Equipment directive 2012/19/EU

(WEEE)

9.9 DELIVERY, STORAGE, AND HANDLING

1. Deliver VFDs covered and protected, in shipping splits of lengths that can be moved past obstructions in delivery path.
2. Store VFDs indoors on dunnage in clean, dry space with uniform temperature to prevent condensation. Protect VFDs from exposure to dirt, fumes, water, corrosive substances, and physical damage.

9.10 COORDINATION

1. Coordinate layout and installation of VFDs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
2. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
3. Coordinate features, accessories, and functions of each VFD and each installed unit with ratings and characteristics of supply circuit, motor, control circuits, required control sequence, and duty cycle of motor and load.

9.11 WARRANTY

1. Special Warranty: Manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.
2. Warranty Period: Five years from date of Substantial Completion.

9.12 Products

9.13 MANUFACTURERS

1. Subject to compliance with requirements, provide products by one of the following:
    1. ABB Low Voltage Drives.

9.14 VARIABLE FREQUENCY DRIVES

1. Description: Variable-frequency motor drive / controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
    1. IGBT, PWM; NEMA ICS 2, UL 508A listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design A and B, premium efficiency 3-phase induction motor by adjusting output voltage and frequency.
    2. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
2. Application: Variable torque.
3. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
4. Output Rating:
    1. Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range.
5. Unit Operating Requirements:
    1. Input AC Voltage Tolerance of 380 to 500 V, plus or minus 15 percent.
    2. Input AC Voltage Unbalance: Not exceeding 3 percent.
    3. Input Frequency Tolerance of 50/60 Hz, plus or minus 3 percent.
    4. Minimum Efficiency: 97 percent at 60 Hz, full load.
    5. Minimum Displacement Primary-Side Power Factor: 98 percent.
    6. Minimum Short-Circuit Current (Withstand) Rating: in compliance with Division 26.
    7. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
    8. Starting Torque: 100 percent of rated torque or as indicated.
    9. Speed Regulation: Plus or minus 5 percent.
    10. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
6. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.

7. Isolated control interface to allow controller to follow control signal over a 40:1 speed range.
    1. Electrical Signal: 4 to 20 mA at 24 V.
8. Internal Adjustability Capabilities:
    1. Minimum Speed: 5 to 25 percent of maximum rpm.
    2. Maximum Speed: 80 to 100 percent of maximum rpm.
    3. Acceleration: 0.1 to 999.9 seconds.
    4. Deceleration: 0.1 to 999.9 seconds.
    5. Current Limit: 30 to a minimum of 150 percent of maximum rating.
9. Self-Protection and Reliability Features:
    1. Input transient protection by means of surge suppressors.
    2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
    3. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
    4. Critical frequency rejection, with three selectable, adjustable deadbands.
    5. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, Class 10 performance.
    6. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
    7. Instantaneous line-to-line and line-to-ground overcurrent trips.
    8. Loss-of-phase protection.
    9. Reverse-phase protection.
    10. Short-circuit protection.
    11. Motor overtemperature fault.
10. Multiple-Motor Capability: Drive suitable for service to multiple motors and having a separate overload relay and protection for each controlled motor. Overload relay shall shut off controller and motors served by it when overload relay is tripped.
11. Automatic Reset/Restart: Attempts three restarts after fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to drive, motor, or load.
12. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
13. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
14. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
15. Integral Input Disconnecting Means and OCPD: UL 489, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.
    1. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFD input current rating, whichever is larger.

9.15 CONTROLS AND INDICATION

1. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
    1. Power on.
    2. Run.
    3. Overvoltage.
    4. Line fault.
    5. Overcurrent.
    6. External fault.
2. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
3. Control Authority: Supports at least four conditions: Off, local manual control at VFD, local automatic control at VFD, and automatic control through a remote source.

3. Historical Logging Information and Displays:
   1. Real-time clock with current time and date.
   2. Running log of total power versus time.
   3. Total run time.
   4. Fault log, maintaining last four faults with time and date stamp for each.
4. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in drive door and connected to indicate the following parameters:
   1. Output frequency (Hz).
   2. Motor speed (rpm).
   3. Motor status (running, stop, fault).
   4. Motor current (amperes).
   5. Motor torque (percent).
   6. Fault or alarming status (code).
   7. PID feedback signal (percent).
   8. DC-link voltage (VDC).
   9. Set-point frequency (Hz).
   10. Motor output voltage (V).
5. Control Signal Interface:
   1. Electric Input Signal Interface: A minimum of two analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
   2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
      1. 0 to 10-V dc.
      2. 0-20 or 4-20 mA.
      3. Potentiometer using up/down digital inputs.
      4. Fixed frequencies using digital inputs.
      5. RS485.
   3. Output Signal Interface:
      1. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
         1. Output frequency (Hz).
         2. Output current (load).
         3. DC-link voltage (VDC).
         4. Motor torque (percent).
         5. Motor speed (rpm).
         6. Set-point frequency (Hz).
         7. Instantaneous power consumption
   4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
      1. Motor running.
      2. Set-point speed reached.
      3. Fault and warning indication (overtemperature or overcurrent).

4. PID high- or low-speed limits reached.

6. Communications: Provide an RS485 interface allowing VFD to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFD to be programmed via BMS control. Provide capability for VFD to retain these settings within the nonvolatile memory.

9.16 LINE CONDITIONING AND FILTERING

1. Input Line Conditioning: Based on the manufacturer's harmonic analysis study and report, provide input filtering, as required, to limit total demand (harmonic current) distortion and total harmonic voltage demand at the defined point of common coupling to meet IEEE 519 recommendations.
2. Output Filtering. Provide sine wave output filtering.
3. [EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3.]

9.17 BYPASS SYSTEMS

1. Manual Bypass: Magnetic contactor arranged to safely transfer motor between controller output and bypass controller circuit when motor is at zero speed. Controller-off-bypass selector switch sets mode, and indicator lights give indication of mode selected. Unit shall be capable of stable operation (starting, stopping, and running), with motor completely disconnected from controller (no load).
2. Bypass Controller: NEMA ICS 2, full-voltage, nonreversing enclosed controller with across-the-line starting capability in manual-bypass mode. Provide motor overload protection under both modes of operation with control logic that allows common start-stop capability in either mode.
3. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker, with lockable handle.
4. Isolating Switch: Non-load-break switch arranged to isolate VFD and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.
5. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

9.18 ENCLOSURES

1. VFD Enclosures: NEMA 250, to comply with environmental conditions at installed location.
    1. Dry and Clean Indoor Locations: Type 1.
    2. Outdoor Locations: Type 3R.
    3. Kitchen or Wash-Down Areas: Type 4X, stainless steel.
    4. Other Wet or Damp Indoor Locations: Type 4.
    5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
2. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFD as "Plenum Rated."

9.19 ACCESSORIES

1. Devices shall be factory installed in enclosure, unless otherwise indicated.
2. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
3. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
4. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
5. Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.
6. Supplemental Digital Meters:
    1. Elapsed-time meter.
    2. Kilowatt meter.
    3. Kilowatt-hour meter.
7. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, Type 4 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
8. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 3R enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
9. Spare control-wiring terminal blocks; wired.

9.20 SOURCE QUALITY CONTROL

1. Testing: Test and inspect VFDs according to requirements in NEMA ICS 61800-2.
    1. Test each VFD while connected to its specified motor.
    2. Verification of Performance: Rate VFDs according to operation of functions and features specified.

2. VFDs will be considered defective if they do not pass tests and inspections.pip
3. Prepare test and inspection reports.

9.21 EXECUTION

9.22 EXAMINATION

1. Examine areas, surfaces, and substrates to receive VFDs for compliance with requirements, installation tolerances, and other conditions affecting performance.
2. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFD installation.
3. Examine VFD before installation. Reject VFDs that are wet, moisture damaged, or mold damaged.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

9.23 APPLICATIONS

1. Select features of each VFD to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.
2. Select horsepower rating of controllers to suit motor controlled.

9.24 INSTALLATION

1. VFDs to be mounted by Mechanical Contractor and connected by the Electrical Contractor unless noted otherwise. Electrical Contractor to confirm need for disconnect switch in addition to VFD and provide if necessary.
2. Wall-Mounting: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall.
3. Free Standing: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor, unless otherwise indicated, and by bolting units to Unistrut or similar support system.
4. Comply with mounting and anchoring requirements specified in Division 26.
5. Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26.

9.25 IDENTIFICATION

1. Identify VFDs, components, and control wiring according to Section 20 05 53 “Mechanical Systems Identification”

9.26 CONTROL WIRING INSTALLATION

1. Install wiring between VFDs and remote devices and facility’s central-control system. Comply with requirements in Division 26.
2. Bundle, train, and support wiring in enclosures.
3. Connect selector switches and other automatic-control devices where applicable.
    1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
    2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

9.27 CONNECTIONS

1. Conduit installation requirements are specified in Division 26. Drawings indicate general arrangement of conduit, fittings, and specialties.
2. Ground equipment according to Division 26.

9.28 FIELD QUALITY CONTROL

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Manufacturer’s Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
3. Perform tests and inspections with the assistance of a factory-authorized service representative.
4. Acceptance Testing Preparation:
    1. Test insulation resistance for each VFD element, bus, component, connecting supply, feeder, and control circuit.
    2. Test continuity of each circuit.
5. Tests and Inspections:
    1. Inspect VFD, wiring, components, connections, and equipment installation. Test and adjust controllers,

components, and equipment.

2. Test insulation resistance for each VFD element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFD locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections, and prepare reports:
    1. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFD. Remove front panels so joints and connections are accessible to portable scanner.
    2. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFD eleven (11) months after date of Substantial Completion.
    3. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
10. VFDs will be considered defective if they do not pass tests and inspections.
11. Prepare test and inspection reports, including a certified report that identifies the VFD and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

9.29 STARTUP SERVICE

1. Engage a factory-authorized service representative to perform startup service.
    1. Complete installation and startup checks according to manufacturer's written instructions.

9.30 ADJUSTING

1. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
2. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
3. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager before increasing settings.
4. Set the taps on reduced-voltage autotransformer controllers.
5. Set field-adjustable circuit-breaker trip ranges as specified in Division 26.
6. Set field-adjustable pressure switches.

9.31 DEMONSTRATION

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFDs.

10. SUMMARY OF DELIVERABLES

1. Driller's log and TWG report as outlined in Section 3 complete with recommendations regarding optimal GW production well design (overall depth, GW production zone(s) depth, GW production screen design, etc.) to return the targeted GW rate of 1,075 GPM into the aquifer.

2. GW step-production rate test report as outlined in Section 5 complete with conclusions and recommendations on realistically achievable sustained production rates.

3. The Owner and Introba shall be copied on all submissions.

11. EQUIPMENT SCHEDULE

1. The contractor shall supply and install a submersible pump that meets the requirements listed in the equipment schedule below, in addition to the requirements listed in section 8.

SUBMERSIBLE PUMP SCHEDULE	
TAG	P-2
SERVICE	GROUND WATER DISTRIBUTION
LOCATION	OSU PRODUCTION WELL
PUMP TYPE	SUBMERSIBLE WELL PUMP
MANUFACTURER	FRANKLIN ELECTRIC
MODEL NUMBER	475 GPM 8” 75 HP SS SR SUB-TURBINE
NUMBER OF STAGES	7
OPERATING RANGE (GPM)	100-495
HEAD (FT. HD)	435
MOTOR POWER (HP)	75
MOTR RPM	3450
VOLTAGE/FREQUENCY/PHASE	460/60/3
DISCHARGE NPT SIZE (INCHES)	6”
DISCHARGE PIPE PRESSURE RATING (PSIG)	314 @68°F
PUMP BOWL DIAMETER (INCHES)	
MOTOR SIZE (INCHES)	8”
WELL CASING DIAMETER (INCHES)	12”
NOTES	- ALL PUMP COMPONENTS TO BE MADE OF STAINLESS STEEL 304 OR EQUIVALENT - ALL MOTOR COMPONENTS TO BE MADE OF STAINLESS STEEL 316 OR EQUIVALENT - C/W INTEGRATED CHECK VALVE

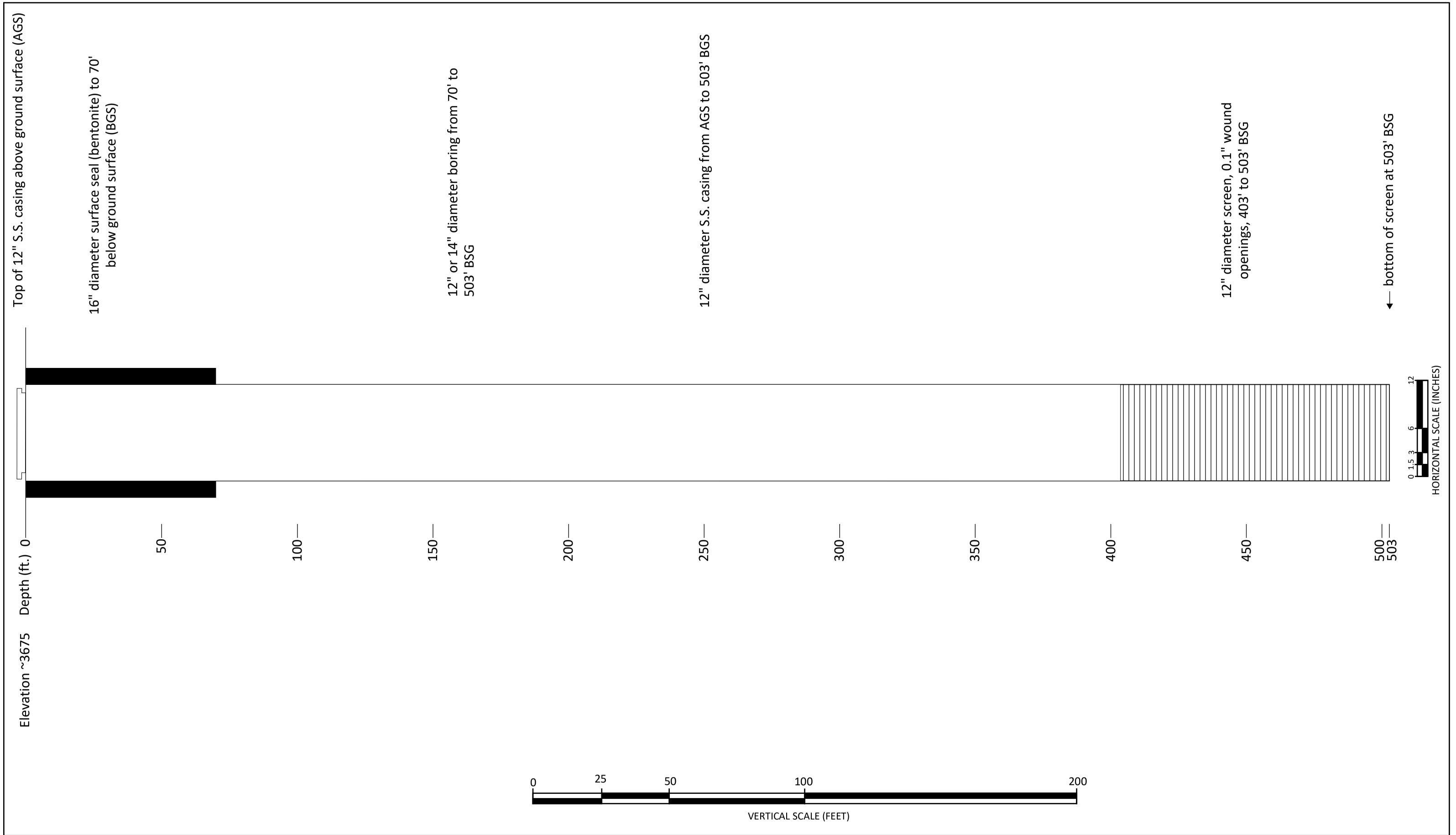
2. The contractor shall supply and install pitless adapters that meet the requirements listed in the equipment schedule below, in addition to the requirements listed in section 8.

PITLESS ADAPTER FOR GW PRODUCTION WELLS	
TAG	PS-2
SERVICE	GW PRODUCTION WELL OSU
LOCATION	OSU PRODUCTION WELL
MANUFACTRER	MAASS MODEL MB PITLESS UNIT IN 304 STAINLESS STEEL
UPPER BARREL DIAMETER (IN)	14”
WELL CASING DIAMETER (IN)	12”
PUMP COLUMN DISCHARGE PIPE (IN)	6”
BURY DEPTH (FT)	5' 3" (CAP TO EXTEND 24” ABOVE GROUND)
ACCESSORIES	PROVIDE THE FOLLOWING ACCESSORIES: - SEALED WIRE CONNECTIONS - AIRLINE TEST BLOCKS - TORQUE ARRESTOR AND LIFT-OUT BAIL AND HOLD DOWN RING - 6” FLANGED HORIZONTAL CONNECTION C/W BLANK FLANGE
NOTES	- STAINLESS STEEL INSERTS USED AT "O" RING SEALS AND SPOOL SEAT SURFACES - ALL WETTED PARTS MADE OF STAINLESS STEEL - CASING TO BE STAINLESS STEEL 304 - PITLESS ADAPTOR INSTALLATION TO INCLUDE HDPE AIRLINE PIPE FOR TAKING FUTURE GW LEVEL READINGS.

END

APPENDIX 'A' –

Hydrogeologist Well Drawing



WALLACE GROUP
NORTHWEST GEOSYSTEM EXPERTS

WELL LOG
PROPOSED PRODUCTION WELL
OSU CASCADES
21500 SW CHANDLER AVENUE
BEND, OREGON

PROJECT NO.:	24194(1)
DRAWN ON:	12/26/2024
DRAWN BY:	AGW
CHECKED BY:	SMC

FIGURE
1