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SECTION 26 0000 – ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Related Documents
   1. Bidding Requirements, Conditions of the Contract and pertinent portions of Sections in Division 00 of these Specifications apply to the Work of this Section as fully as though repeated herein.

B. THE CONTRACTOR SHALL ALSO REFER TO THE OTHER DIVISIONS OF THE PLANS AND SPECIFICATIONS FOR INFORMATION WHICH PERTAINS TO THE ELECTRICAL SECTION.

C. The work included in the project shall include the furnishing of all required labor and materials for a complete and operable electrical system, as indicated on the accompanying drawings and as required by the project manual, inclusive of all appurtenances not specifically shown or covered by the specifications but required for complete operation of the electrical system as defined in the documents. The work shall also include the testing, adjustment, start-up and troubleshooting of the electrical equipment and the training of the Owner's operating personnel in its operation and maintenance.

D. It shall be the responsibility of the Contractor to furnish a complete and fully operating system. The Contractor shall be responsible for all details which may be necessary to properly install, adjust and place in operation the complete installation. The Contractor shall assume full responsibility for additional costs which may result from unauthorized deviations from the contract documents.

1.2 VERIFICATION OF DRAWINGS

A. The contract drawings indicate the required size of conduit and cable for wiring. The locations of equipment shall be verified in the field by the Contractor. In the event it should become necessary to change the location of any work due to interference with other work, consult with the Engineer before making any changes. The Contractor shall determine and be responsible for the proper location and character of all anchor bolts, inserts, hangers, sleeves, etc. for the electrical equipment, unless specifically detailed otherwise.

1.3 ELECTRONIC DEVICE PROTECTION

A. Any electronic device specified shall be internally self-protected against abnormal operating conditions. As a minimum, the equipment shall not be damaged by continuous voltage variations of +10, -15% from the nominal operating point. Each device shall have transient protections and instantaneous undervoltage protection to prevent failure or damage to the device. When an abnormal voltage situation exists, the unit or system shall "lock" itself out until the situation is corrected if the abnormality is detrimental to the operation of the device. System protection through the blowing of fuses or tripping of circuit breakers is unacceptable. Circuit breakers or fuses shall be used for "normal" component failure protection, or protection from severe faults, overloads, where applicable, or lightning strikes. Normal operation, which

shall not damage or alter the tolerances, calibration, accuracy, etc. of the system and its components, shall include motor starting, switchgear operation, engine-generator operation, electric welder operation, etc.

1.4 SUBMITTALS

A. The Contractor shall submit for approval complete shop details for all equipment including but not limited to:
   1. Control panel, including all internal components
   2. Instrumentation and control devices
   3. Instrumentation and control loops
   4. Cable and conduit
   5. Other devices and systems, including complete schematic and interconnection diagrams, with detailed parts lists and other information required by the Engineer.

B. Submittal shall be in compliance with applicable paragraphs of the project manual.

C. Operating and maintenance manuals shall be provided as defined in the project manual. The manual shall include a complete parts list. The manuals shall be submitted with the shop drawings.

D. Submittals shall include complete schematic diagrams of individual devices and system diagrams. Manufacturer's standard "cut sheets" are not acceptable.

1.5 ALTERNATES, SUBSTITUTIONS

A. If the Contractor proposes to substitute equipment of manufacturers other than those indicated, they shall submit written requests to the Engineer at least 10 days before he submits shop drawings. Failure to furnish such an itemized list will be interpreted to mean that the Contractor agrees to provide equipment of the specified manufacturer(s). The itemized list shall include the name of the proposed manufacturer and the model or catalog number of each proposed item. In addition, the Contractor shall attach catalog data, prints, diagrams, specifications, etc., as necessary to permit the Engineer to evaluate the proposed substitution properly. Alternates are accepted on the basis of alternate manufacturers. Submitting alternates for approval in no way permits the manufacturer to deviate from levels of quality or specific requirements as defined in the contract documents.

B. Where the contract documents state that equipment shall be manufactured by one specified manufacturer or equal, the Contractor shall, at his discretion, submit proposals in the form of shop drawings for alternative equipment that is equal to that offered by the specified manufacturer. The Engineer reserves the right to disapprove this alternative equipment if, in his opinion, it is not equal in quality, durability, appearance, strength, performance, design physical dimensions and arrangement to the equipment offered by the specified manufacturer.

C. Where a contractor proposes to use an item of equipment other than that specified or detailed that is approved by the Engineer and that item requires redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical, or architectural layout, then such redesign, new drawings, detailing and all construction required for it shall be prepared by the Contractor without extra compensation.

D. Similarly, when a quantity and arrangement of ductwork, piping, wiring and equipment are required that is different from that specified or indicated on the drawings, the Contractor shall provide all ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring, and any other additional equipment required without extra compensation.

E. Acceptance or rejection of the proposed substitutions shall be subject to the approval of the Engineer. Under no circumstances will the Engineer be required to prove that an item proposed for substitution is not equal to the specified item. It is mandatory that the Contractor submit to the Engineer in writing all evidence required to support his contention that the item proposed for substitution is equal to the item indicated in the contract documents. If requested by the Engineer, the Contractor shall submit for inspection samples of both the specified and proposed substitute items.

1.6 NAMEPLATES

A. Each piece of equipment shall have a standard nameplate securely affixed in a conspicuous place, showing the manufacturer, model number and serial number as is applicable. The nameplate of the distributing agent only will not be acceptable.

1.7 QUALITY

A. All work shall be installed by skilled mechanics in a neat and workmanlike manner and shall be approved by the Engineer before final acceptance by the Owner.

B. If equipment is furnished having power and control requirements other than as specified, the Contractor shall make all necessary changes and furnish a complete set of drawings for installing the alternate equipment. The installation shall comply with the requirements of the 2017 edition of the National Electrical Code, local and state codes and ordinances. Where the contract documents call for workmanship or materials in excess of code requirements, the project manual shall take precedence. Electrical equipment and materials shall be Underwriters Laboratory approved, where UL standards for such products exist.

C. All equipment to be installed on the project shall be new and unused. Existing equipment, if applicable, shall be reused only after obtaining written permission from the Engineer.

1.8 GUARANTEE

A. The Contractor shall guarantee the operation of the installation and that the materials and workmanship of the equipment be free from defects for a period of two (2) years from the date of substantial completion (as noted in the Specifications), providing the equipment has been operated and maintained in accordance with the manufacturer's recommendations. If a dispute exists regarding whether the equipment has been maintained according to the manufacturer's recommendations, the Engineer's decision will be final. The guarantee shall include all parts and labor necessary to return the system to normal operation. The guarantee on all equipment shall start after formal acceptance of equipment as defined by the General Conditions and after successful completion of start-up procedures.

PART 2 – PRODUCTS – Not used

PART 3 – EXECUTION

3.1 GENERAL

A. The following items shall be included in the work to be done:
   1. All work shall be under the direct supervision of a master electrician.
   2. Furnish permits as required for electrical construction. Pay all electrical inspection charges for the construction.
   3. Furnish and install all power, control, and signal conduit and cable.
   4. Furnish and install the ground system and complete all grounding connections.
   5. Furnish and install lighting fixtures and convenience outlets complete with fixtures, switches, receptacles, cable, conduit and other necessary material.
   6. Furnish and install electrical equipment as specified in accordance with the manufacturer's recommendations, instructions and directions. All equipment shall be properly protected during construction.
   7. Mount all equipment on concrete pads unless shown otherwise.
   8. Complete all connections and test operate the equipment in cooperation with the Owner, the Engineer and others working on the project.
   9. The Contractor shall furnish and install control devices, instrumentation, all electrical wiring to the proper terminals of all control devices and instrumentation, including devices furnished by others, to obtain successful operation of the equipment.

3.2 TOOLS

A. All special tools required for servicing equipment furnished under Division 26 shall be delivered, properly identified as to use, to the Owner prior to acceptance of the work. Adapters, electrical and other equipment necessary for servicing and maintaining the system shall also be delivered to the Owner in the same manner.

3.3 INSPECTION

A. The Contractor shall inspect all the electrical equipment and shall notify the Engineer in writing before the equipment is installed if the equipment appears to be deficient in fit, form or function.

3.4 CONSTRUCTION

A. The Contractor, under this portion of the contract, shall be responsible for all cutting, patching, excavation, backfill, sleeves, chases, openings, etc. for equipment specified in this portion of the contract documents or for cable and conduit and associated electrical equipment that is specified in this portion of the contract documents to serve equipment that is provided by a different portion of these documents. If the Contractor provides equipment that has power and control requirements that are different from those specified, then that Contractor shall be responsible for any additional costs incurred for engineering, construction, and all wiring changes required to make the alternate equipment perform per the intent of the contract documents.

B. All patching, cutting, etc. shall have a finish that is compatible with the final finish of the remainder of the surface and shall meet with the approval of the Engineer.

3.5 COORDINATION

A. It shall be the sole responsibility of the Contractor to coordinate among suppliers and contractors providing equipment for the project.

B. The coordination shall include, but not be limited to, gas and liquid pressures and flows, restrictions, operators, signal compatibility, signal level, reference points, input and output resistance, power requirements, etc.

C. It shall be the responsibility of the Contractor to provide any and all interfaces, isolation devices, buffers, signal converters, alternators, amplifiers, etc. required to make each system function alone and with all other systems per the intent of the specification. If one system causes interference, noise, attenuation of signals, erroneous or erratic signals or another part of the same loop, or on other control power, or instrumentation loops, it shall be the sole responsibility of the Contractor to remedy and rectify the situation to the satisfaction of the Engineer without additional cost to the Owner.

3.6 ERECTION AND INSTALLATION SUPERVISION

A. The manufacturer or single source supplier of equipment included in each section shall supervise or otherwise direct the proper installation or erection of all equipment included in that section.

3.7 FIELD TESTING

A. Field testing shall be performed as specified under the detailed specifications for the specific equipment item and also in accordance with requirements of Division 00 for overall testing.

3.8 INSTALLATION

A. Each item shall be furnished complete and installed in accordance with the manufacturer's recommendations, instructions and directions. All installed equipment shall be properly protected during subsequent construction operations.

B. Unless shown otherwise, all material shall be new, undamaged and conform to the latest standards for the applicable equipment.

C. The Contractor shall provide all scaffolding required for the proper installation of this work in conformance with the standards of all local and state safety codes applying to scaffolding.

D. Cooperate with other trades to avoid interferences in the installation of this work. Install all equipment and systems so as not to delay progress of construction and correlate with other trades to avoid delay. Should differences of opinion develop, the Engineer's decision will be final.

E. The Contractor shall keep the premises clean and orderly during installation of this work, remove rubbish periodically and as may be directed by the Engineer. Upon completion of this

part of the project, remove all dirt, debris, tools, scaffolding, etc. used or resulting from this work.

F. All electrical equipment subject to impact loadings from contact or breaker operation and all equipment subject to potential stresses from fault current or subsequent protective device operation shall be adequately bolted in place, braced, etc. to resist the mechanical forces.

3.9 INSPECTION, START-UP AND ADJUSTMENT

A. The manufacturer or single source supplier of equipment included in each section shall inspect the completed installation and make all necessary adjustments, corrections or modifications prior to start-up as authorized by the Engineer. After start-up, the manufacturer shall make all final adjustments necessary for the intended use of the equipment and certify in writing that the equipment has been properly installed and adjusted and is operating satisfactorily.

3.10 WRITTEN REPORT

A. Upon completion of the requirements of Articles dealing with erection, field testing, and inspection, three (3) copies of a written report shall be submitted to the Engineer confirming completion of all requirements and outlining any special instructions for the operation or maintenance of the equipment in each section. This report shall be signed by the Contractor and the manufacturer or his agent.

3.11 OPERATOR TRAINING

A. The manufacturer or single source supplier shall provide the minimum number of hours of operator training as specified in each section on the proper use and maintenance of the equipment. The hours shall not necessarily be consecutive. Time of operator training shall be coordinated with and agreeable to the Owner.

END OF SECTION 26 0000

SECTION 26 0500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Bidding Requirements, Conditions of the Contract and pertinent sections of Division 00 of these Specifications apply to the Work of this Section as fully as though repeated herein.

1.2 QUALITY ASSURANCE

A. All material shall meet the requirements of the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA) specifications and local codes and ordinances, and shall be Underwriters Laboratories listed, where UL standards for such products exist.

1.3 SUBMITTALS

A. The Contractor shall submit complete shop drawings, instruction manuals, and record drawings. The quantity and general format shall be as defined in the General Conditions.

B. After installation and before the final acceptance of the equipment, bound books containing the record drawings in addition to complete information in connection with the assembly, operation, adjustments, maintenance and repair of all equipment, together with a detailed parts list with drawings and photographs shall be furnished. The quantity and format shall be as defined in the General Conditions.

C. The shop drawings submittal shall conform to the requirements of the contract documents.

PART 2 – PRODUCTS

2.1 CONDUCTORS - COPPER - 600V

A. Conductors shall be of soft drawn, annealed copper, having a conductivity of not less than 98% of pure copper. Conductors shall be NEMA Class B stranded. The conductors shall conform to ICEA and NEMA standards.

B. The minimum size for wiring shall be #14 AWG copper, unless shown otherwise. All conductor sizes are based on copper with THWN insulation rated at not less than 75°C and suitable for wet and dry locations unless noted otherwise.

C. All circuits shall be installed using wire with 600V insulation, unless wire with a different voltage rating is indicated. The insulation, as a minimum, shall have a conductor rating of not less than 75°C in both wet and dry locations. All cable shall have the same type of insulation by the same manufacturer throughout the project. Insulation shall meet all applicable NEMA and ICEA standards.

D. All lugs shall be suitable for 75°C, minimum.

E. Control cable and all power cable shall be stranded.

2.2 CONTROL CABLE

A. Multi-conductor cable shall be installed and shall have not less than the number of conductors required by the application.

B. The conductors shall be of soft drawn, annealed copper having a conductivity of not less than 98% pure copper, and shall be NEMA Class B stranded. The wire size shall be #14 AWG unless shown otherwise.

C. All circuits shall be installed using wire with 600 volt insulation, unless a different voltage rating is indicated. The insulation type shall be suitable for not less than 75°C in a wet or dry location. All cable shall have the same type of insulation by the same manufacturer throughout the project.

D. Control cable shall have each conductor insulated with code grade insulating fillers where required, to provide a round cable; tape over the insulated conductors and fillers; and a polyvinyl chloride jacket over all. The fillers and binders shall be of moisture-resisting type. Each conductor of each cable shall have insulation color-coded in accordance with ICEA standards. The color coding of the insulation shall be clear through the insulation, an exterior layer only of color coding is not acceptable.

E. No splices shall be made in wire or cable unless specifically detailed otherwise. Conductors shall be continuous between devices and shall be terminated with pressure type connectors. The terminators shall be preinsulated, flanged, slotted tongue, indenter type lugs. Soldered type terminators are not acceptable.

2.3 SIGNAL CABLE

A. Signal cable shall be supplied where required. Signal cable shall meet the following requirements: The conductors shall be not less than 16 gauge, 7 strand min., Class B, tin coated concentric bare copper wire with a 15 mil (nominal) 90°C PVC primary insulation. The conductors shall be shielded with .35x5 mil (min.) 100% coverage aluminum or copper Mylar tape shield, or equal, and an 18 gauge strand copper wire drain wire. The outer jacket shall be 20 mils (nominal) 75°C PVC suitable for wet or dry locations.

2.4 VARIABLE FREQUENCY DRIVE (VFD) CABLE

A. Cable used for VFD output connections to motors shall be specifically designed for use with variable frequency drives, to minimize potential of cable failure or motor damage from harmonics, corona discharges, distortion or other factors.

B. Stranded and tinned copper conductors for power and ground.

C. Double shielded with aluminum foil and copper braid, 85% coverage minimum.

D. Crosslinked polyethylene insulation.

2.5 CABLE IDENTIFICATION

A. Each power, control and signal cable identified on the drawings shall be identified by plastic tags permanently attached to the cable. The tags shall be attached to each cable at each termination and wherever the cable is accessible in junction or pull boxes. Tags shall be marked with printing showing the circuit number.

B. The cable marking system shall be Raychem TMS cable identification system utilizing a typewriter and TMS permatizer, or equal.

2.6 CONDUITS, FITTINGS, BOXES AND DEVICES

A. The Contractor shall supply conduit, couplings, connectors, junction boxes, fittings and all other required items for a complete raceway system. The conduit fills indicated in the contract documents are based on copper conductors with THWN insulation suitable for 75°C insulation in both wet and dry locations. The Contractor shall resize conduits for other conductor and/or insulation systems, if approved. The conduit shall be reamed and cleaned and made free of burrs. Exposed conduit runs shall be straight and true with the building lines and elbows, bends and offsets shall be uniform and symmetrical. All conduit runs shall be installed with adequate means for drainage provided at low points.

B. Rigid Steel Conduit:
   1. Where shown, the conduit used shall be hot dipped galvanized, including the threads. Unless specified otherwise the conduit shall not be smaller than 3/4". The conduit shall bear the UL label.
   2. Job site threading need not be galvanized. However, job site threading shall be painted with oil base primer to prevent oxidation of the threads.
   3. The use of "threadless" connectors with rigid steel conduit is not acceptable.
   4. Intermediate metal conduit shall not be acceptable.

C. PVC Conduit:
   1. Where shown, the Contractor shall furnish and install PVC conduit. Unless specified otherwise the conduit shall not be smaller than 3/4". The conduit shall bear the UL label.
   2. The conduit shall be supported as recommended by the manufacturer or as required by applicable codes and ordinances, whichever is the more stringent. The conduit shall be composed of high impact PVC conduit and shall be rated for 90°C wire. The conduit shall be listed for underground, encased, and exposed applications. The PVC conduit system shall contain fittings for connecting the system to cast junction boxes and other devices as required.
   3. Wherever a PVC conduit system is used the Contractor shall furnish and install copper ground conductors. The conductors shall be continuous with no splices or joints unless permitted by the National Electrical Code. The size of the ground conductor shall be as required by the National Electrical Code or as shown on the drawings, whichever is more stringent.
   4. PVC conduit is permitted only where specifically shown. All other areas must use galvanized rigid steel or as required by the contract documents.

D. Flexible Sections:

1. Unless equipment is factory wired, the conduit system shall be joined to the equipment with waterproof flexible metallic conduit. The conduit shall be cold rolled steel, galvanized strip shall meet the requirements of a one minute Preece dip test. The galvanized flexible conduit shall be covered with 40 mils +5 PVC coating. The tensile strength of the PVC shall exceed 1600 psi. The flexible conduit shall be connected to the equipment and conduit system with waterproof, oil proof and dust proof connectors which are designed for use with the flexible conduit installed. All flexible conduit and fittings shall be UL approved. The minimum and maximum lengths of flexible connectors shall be sixteen (16) and thirty (30) inches respectively. The flexible conduit shall not be used for grounding equipment. A separate conductor in accordance with NEC Section 250 shall be installed inside the flexible section.

E. Boxes - Cast:

1. Outlet and junction boxes shall be of the weatherproof, galvanized cast, ferrous alloy type with threaded hubs for use with rigid steel conduit. The boxes shall bear the UL label.

F. Boxes - Non-Metallic:

1. The Contractor may utilize non-metallic boxes where shown. All boxes shall bear the UL label and have one (1) hour minimum fire rating.
2. The Contractor shall not use non-metallic boxes in walls and/or ceilings forming a fire-resistive membrane, unless rated for such installation.

G. Wiring Devices - Specification Grade:

1. Wiring devices shall be AC quiet, NEMA specification grade, heavy duty unless otherwise specified. All devices shall meet Federal and NEMA standards, and shall be listed by the Underwriters Laboratories. The voltage rating shall be as required for the application. The devices shall have an ampacity of not less than 20 amps.
2. Wall plates shall be stainless steel. All switches, other than lighting switches, shall have an engraved label identifying the function of the switch and switch positions.
3. Where applicable, devices located in hazardous areas or areas where adverse conditions exist, shall meet NEMA and NEC requirements for those areas.

H. Switch Labels

1. All switches, other than lighting switches, shall have an engraved label identifying the function of the switch and switch positions. Labels shall be stainless steel, brass, or engraved laminated plastic, attached with screws.

PART 3 – EXECUTION

3.1 INSTALLATION

A. The Contractor shall furnish, install, wire and start-up equipment as required by the contract documents. The manufacturer's installation recommendations shall be observed and the com-

pleted assembly shall meet applicable code requirements.

3.2 SIGNAL CABLE CONNECTIONS

A. Where the Contractor connects signal cable or cables with low signal levels to devices, etc. the connections shall be by terminal strips with screws, etc. Where splices inside junction boxes, etc. are made the splices shall be by means of pressure type nylon insulated butt connectors. After the connection is made the connection shall be wrapped with PVC plastic tape to form a moisture resistance connection. "Wire nuts" are unacceptable.

3.3 CONDUIT INSTALLATION - RIGID STEEL

A. The conduit used shall be hot dipped galvanized, including the threads. Unless specified otherwise, the conduit shall not be smaller than ¾”.

B. Job site threading need not be galvanized. However, job site threading shall be painted with oil base primer to prevent oxidation of the threads.

C. The use of ‘threadless’ connectors with rigid steel conduits is not acceptable.

D. Intermediate metal conduit shall not be acceptable.

3.4 CONDUIT INSTALLATION - PVC CONDUIT

A. Where specified, the Contractor may use PVC conduit. The conduit system shall be fabricated using a solvent type of joining liquid to create watertight joints.

B. When installed below grade the conduit shall be installed not less than 3.5 feet deep, or the code established depth for frost, whichever is deeper. When the conduit's installation depth is less than the specified depth, the Contractor shall transition to, and use rigid steel. Likewise, when the conduit system is to penetrate a building wall the conduit system shall transition to rigid steel prior to entering the wall.

C. The specified conduit systems are based on rigid steel without a ground conductor. When a PVC system is installed the Contractor shall provide a copper ground conductor from the branch circuit device to the final circuit element. The conduit systems shall be sized to accommodate the ground conductors at no change in the contract amount.

3.5 CONDUCTOR INSTALLATION

A. Conductors shall be installed using industry accepted techniques as defined by Underwriters Laboratories, National Electrical Code, NEMA, ICEA, and other applicable standards. The Contractor shall use approved pulling compound where applicable.

B. No splices shall be made in power wiring except in junction boxes. Conductors shall be continuous from outlet to outlet. Wiring shall be terminated as required in the contract documents.

C. No splices shall be made in signal or control conductors. The wiring shall be continuous from

device to device.

D. All wire and cable shall be tested for grounds and continuity before the circuit is energized. The Contractor shall assume full responsibility for damage done to the equipment due to circuit grounds or open circuits.

3.6 UNDERGROUND WORK

A. The Contractor shall be responsible for all excavating, concrete work where applicable, and backfilling. The underground conduit shall be at least 30 inches below the finished grade.

B. Backfill shall be earth or sand tamped into place. The trench shall be filled to the top and the surface restored to a finished condition. All excess earth shall be removed.

3.7 CABLE SPLICES

A. Power cables or control circuit cables that are spliced in locations that are subject to damp or wet locations shall be spliced using 3M cast splice kits, or equal.

3.8 DEVICE MOUNTING

A. In finished areas the switches shall be mounted 48 inches to center above the floor, and receptacles shall be mounted 18 inches to center above the floor. In unfinished areas, switches and receptacles shall be mounted 48 inches (nominal) to center above the floor. Outdoors, or in areas with adverse conditions, the switches and receptacles shall be mounted in cast ferrous alloy boxes with weatherproof cast ferrous alloy cover plates.

3.9 SWITCH LABELING

A. All switches, other than lighting switches, shall include an engraved cover plate or an engraved label mounted next to the switch. Labels shall be stainless steel, brass or engraved laminated plastic.

B. Separate labels shall be mounted with anchors and screws. The use of double-back tape or adhesive only is not acceptable.

END OF SECTION 26 0500

SECTION 26 2000 – LOW VOLTAGE ELECTRICAL TRANSMISSION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Bidding Requirements, Conditions of the Contract and pertinent portions of Sections in Division 00 of these Specifications apply to the Work of this Section as fully as though repeated herein.

1.2 MAIN SERVICE

A. The existing service to the lift station is an overhead service at 120/240vac, three phase, 250 amps. It passes from the utility pole to the existing building directly over the location of the new lift station, so for safety the Contractor shall install a temporary service to the site for use during the construction process. The temporary service shall be generally routed around the south side of the construction area in a path that will not interfere with the construction process. Coordinate the exact path.

B. The Contractor shall coordinate the installation of a new 120/208vac, three phase, 200 amp below grade electrical service to the new lift station with the serving utility. The serving utility will provide new transformers on the existing. The contractor will provide below grade secondary service cable and conduit from the utility pole to the new lift station control panel. The contractor will also furnish and install a utility approved meter socket. The serving utility will make connections at the transformer and provide the electric meter. The Owner will separately pay any utility service charges that may occur.

B. The serving electric utility is: Xcel Energy
Attn.: Benjamin Skogstad
Telephone 507-381-4909
Benjamin.w.skogstad@xcelenergy.com

PART 2 – PRODUCTS – Not used

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall furnish, install, wire and start up equipment. See Section 26 00 00 for the requirements for installation, inspection, start up, adjustment, report, training, etc. The entire installation shall be grounded in accordance with the National Electrical Code. Schedule work with the utility to meet the requirements of the overall project schedule.

3.02 SERVICE LATERAL WARNING RIBBONS

A. Warning ribbons shall be installed to identify the location of service laterals per the requirements of the 2017 National Electrical Code, Section 300-5(d).

3.3 SCHEDULING

A. Coordinate scheduling with the serving utility to meet the overall project schedule.

END OF SECTION 26 2000

SECTION 26 24 19 – LIFT STATION CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Bidding Requirements, Conditions of the Contract and pertinent Sections in Division 00 of these Specifications apply to this Section as fully as though repeated herein.

B. The control panel shall include main and branch circuit breakers, an automatic transfer switch, variable frequency drives (VFDs) for operation of the pumps, control switches, limit switches, a programmable logic controller (PLC) with a matching operator interface terminal (OIT) for controlling pump operation, an uninterruptible power supply (UPS), power supplies, control switches, indicator lights, relays, terminal strips and wiring, and other components as required. The Contractor shall install the control panel at the lift station site, along with a submersible level transducer and high/low level float switches in the lift station wet well and an ultrasonic level transmitter mounted over the flume in the metering manhole.

C. The Contractor shall provide all software services necessary for the PLC and OIT to operate the lift station, and to display run and alarm status.

D. The existing supervisory control and data acquisition (SCADA) panel in use for the existing lift station shall be relocated in its entirety to the new lift station control panel enclosure, and reused in the same fashion.

E. All equipment shall meet the requirements of NEMA standards and the latest edition of the National Electrical Code, where applicable.

PART 2 – PRODUCTS

2.01 LIFT STATION CONTROL PANEL

A. The lift station control panel shall be constructed in accordance with Underwriters Laboratories (UL) Standard 698A. The panel shall be shop-inspected by UL, or constructed in a UL-recognized facility. The completed panel shall bear a serialized UL label indicating acceptance under Standard 698A.

B. Enclosures

1. The enclosure shall be NEMA 3R, constructed of 12 gauge stainless steel with rounded corners and continuously welded seams ground smooth. The enclosure shall contain interior sub-panels for mounting all control devices and displays, and the enclosure shall be sufficiently large to accept all components without crowding. Larger enclosures shall contain door and panel stiffeners as required. The supplier shall determine enclosure width and depth as required for the internal components, wire bending spaces, UL-required clearances, SCADA

equipment, etc.

2. The doors shall be fastened to the enclosure with continuous type stainless steel piano hinges and three-point minimum, stainless steel hardware. The doors shall include vault-style handles with provisions for padlocks. Provide a data pocket on the inside of one door.

3. The enclosure shall have dead front inner hinged doors that house all front panel components, including switches, indicator lights, circuit breaker operating handles, running time meters, overload reset pushbuttons, the operator interface terminal and automatic transfer switch control panel, and any other components that require operator access.

4. All panels shall be flanged with corners welded and ground smooth.

5. The enclosure shall be tamper-resistant with no exposed fasteners, and rodent-resistant with no gaps greater than 1/8 inch.

6. The enclosure shall contain electric heater(s) with metal guards for condensation prevention. The heater(s) shall be thermostatically controlled and sized to maintain interior temperature at 32 degrees F in an ambient temperature of -30 degrees F.

7. The enclosure shall include air intake(s) and exhaust fan(s) for cooling during warm weather. The exhaust fan(s) shall be thermostatically controlled, and along with the air intake(s) be appropriately sized for the heat rejection rating of the VFDs to maintain an internal temperature below 40 degrees C / 104 degrees F.

8. Terminate all wiring on barrier type terminal strips. Label terminals per manufacturer's shop drawings.

9. Label all components using engraved laminated plastic nameplates.

10. Provide stainless steel mounting legs, with 14 gauge stainless steel skirting with louvered vent openings as indicated on the Drawings. Fasteners for the skirting shall be tamper resistant stainless steel.

11. The control panel enclosure shall be installed on a reinforced concrete pad as shown in the Drawings. Coordinate the pad size and location during construction.

C. Variable Frequency Drives (VFDs)

1. Provide variable frequency drives (VFDs) for operation of the lift station pumps.

2. The PLC shall start and stop the lift station pumps VFDs, based on wetwell level as measured by the submersible level transmitter. The VFDs shall normally be

operated at a constant speed. The speed shall be configurable from the front panel operator interface terminal.

3. The VFDs shall be Allen-Bradley PowerFlex 525 or equal.

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D. Control Devices

1. All control devices including, but not limited to, selector switches, pushbutton switches, limit switches, and indicating lights shall be of the heavy duty, oil tight type. The contacts shall meet NEMA rating designation A600. The devices shall be Cutler-Hammer Type T, Allen Bradley Bulletin 800T, or Square D Class 9001 units, or equal. Each shall be supplied complete with escutcheon and nameplate.

E. Control Relays

1. Control relays shall be supplied as required. Additional relays shall be provided to starter auxiliary contacts as required. The relays shall be of the plug-in type with associated sockets and retaining clips. The relays shall have dust covers. All contacts shall be rated for not less than 10 amps at 120 VAC with 3/16" diameter gold flashed silver cadmium oxide moving and stationary points. Insulation resistance shall be 1000 megohms, nominal, at 500 VDC between all non-connected terminals. Dielectric withstand shall be 2,000 VAC between non-connected terminals.

F. Timing Relays

1. Plug-in type with dust cover, socket and locking mechanism when mounted horizontally.

2. On-delay or off-delay as required. Delay time adjustable on front of relay, 0 to 5 minutes minimum.

3. Coil: continuous operation at 120 VAC +/-10%

4. Contacts: 2 pole double throw, minimum

a. 10 amps, make-break, 120 VAC, resistive

b. Insulation resistance 1000 megohms at 500 VDC

c. Dielectric: 2000 VAC, 60 Hz

5. Mechanical life: 10^6 operations

6. Temperature: 0^oC to 70^oC.

7. Timing accuracy: 2% of setting

8. Transient protection: 2500 volts, 1 millisecond

G. Circuit Breakers

1. Circuit breakers shall be one, two or three pole devices as required. All circuit breakers shall be UL labeled and shall be of the size shown. Breakers shall have an interrupting rating of not less than 22,000 amps, sym.

H. Receptacle

1. Provide a 120vac GFCI receptacle for use with portable tools, etc.

I. Heater

1. The control panel shall be equipped with a thermostatically controlled electric heater(s), sized to maintain the temperature inside the panel above 32 degrees F. The heater(s) shall be Hoffman DAH series or equal.

J. Submersible Level Transducer

1. The transducer shall have a stainless steel housing. The assembly shall be UL rated, or labeled by a third party organization approved by the local inspection authority as suitable for use in a Class 1, Division 1 environment. If the transducer is not rated for a Class 1, Division 1 environment, provide a UL labeled intrinsically safe barrier.

2. Output shall be 4 - 20 mAdc, proportional to the measured depth of the liquid in the wetwell. Power supply shall be 23 to 40 volts, DC, with reverse polarity protection. Static accuracy +/- 0.25% minimum.

3. The transducer shall be furnished with integral cable that is submersible and approved for the application.

3. Provide a UL labeled intrinsically safe barrier in the control panel for the level transducer.

4. KPSI model 750 or equal.

K. Float Switches - Non-Mercury Type

1. The float switches shall have an inert outer cover with the cord encapsulated into the bulb portion to form a water-tight seal. The float switches shall be of the non-mercury vial type with a SPDT contact arrangement. The cords shall be of type SO extra flexible conductors with an outer jacket over all conductors. The switch and cord assemblies shall be suitable for not less than 4 amps at 120 VAC, 0.8 P.F. The float shall operate from 0 to 60 degrees C. in a liquid with a specific gravity of from 0.65 to 1.50 minimum.

2. Provide UL labeled intrinsically safe barriers in the control panel for the float switches.

3. Anchor Scientific “Eco-Float” or equal.

L. Terminals

1. All connections to external devices shall be terminated on terminal strips. The terminal strips shall be of the barrier type. Each terminal shall be of the two screw type. The contacts shall be tin-plated copper, capable of carrying 10 amps at 600 VAC. The contacts shall be large enough to accept up to and including No. 12 AWG wire. The barrier strip shall have a minimum voltage withstand of 5,000 volts. The barrier strip shall be suitable for the required number of contacts.

M. Surge Arresters

1. Controls shall include surge protectors on all incoming phases, Square D Class 6671 or equal.

N. Indicating Lights

1. LED indicator lights with colored lenses

2. Press-to-test feature.

3. Heavy-duty, oil-tight.

O. Running Time Meters

1. Six digit, hours and tenths.

2. Non-resettable.

3. 3-inch diameter front, nominal

P. Alarm Light

1. 120 VAC powered, LED lamp, enclosure rated for outdoor use.

2. Edwards Signaling 105 series, or approved equal.

Q. Branch Circuits to external locations

1. Provide a 120/208vac three phase 60 amp circuit to supply power to the existing

building on site.

2. For bidding purposes, assume a 120/208vac single phase 30 amp circuit shall be provided to supply power to the generator set for operation of its battery charger and engine block heater. Coordinate the exact requirements for the generator during construction.

3. Provide a 120vac single phase 15 amp circuit for the yard light.

T. Uninterruptible Power Supply

1. The control enclosure shall include a UL labeled, 120VAC uninterruptible power supply for operation of the control system. The unit shall include a sealed battery that will operate the controls for up to 30 minutes when utility power is lost.

U. Programmable Logic Controller (PLC) and Operator Interface Terminal (OIT)

1. Modicon model M221 PLC with integral power supply, digital inputs and outputs, and an analog input module as required.

2. Modicon HMISTU855 with 5.7" color display.

3. The PLC shall start and stop wastewater pumps based on start and stop set point values entered at the OIT, compared to wet well level as measured with a submersible level transducer. Operation of the pumps shall be automatically alternated. The pumps shall also be able to be operated in a fixed sequence if desired. High and low level alarm set points shall also be entered at the operator interface terminal.

4. During normal operation, the pumps will be operated at a constant speed, with the speed configurable from the front panel OIT. However, due to the anticipated low pump speed and the relatively large size of the forcemain, there may be a chance for solids to accumulate in the forcemain pipe. To prevent this, the pumps will be operated at full speed periodically. The time interval between full pump speed operation events shall be configurable from the OIT.

5. Wetwell level as measured by the submersible level transducer shall be displayed on the OIT. High and low level alarm set points shall be configurable at the OIT.

6. Influent flow in gallons per minute as measured by the ultrasonic flow transducer shall be displayed on the OIT. The PLC shall also calculate and display totalized flow in gallons.

4. The PLC shall also monitor for power failure, phase failure, generator running and fail conditions. The PLC shall accumulate and store pump operating time in hours and tenths of hours for each pump.

5. The PLC shall have digital outputs to control relays for pump 1 run, pump 2 run, high level alarm, low level alarm, power fail, generator running, generator alarm, and general lift station alarm output signals to the SCADA panel.

6. Backup pump control shall be provided by float switches and hard wired relay logic as shown in the Drawings.

V. Automatic Transfer Switch and Standby Power Generation

1. Zenith 7000 series, 208VAC, three phase, 200 amps, or approved equal.

2. A standby power generator will be provided under a separate contract. Refer to specification section 26 30 00.

W. ULTRASONIC LEVEL TRANSDUCER AND DISPLAY

1. Furnish and install an ultrasonic level transducer over the flume in the metering manhole to monitor influent flowrate.

2. The ultrasonic level transducer shall be provided with a display unit capable of displaying instantaneous flow in gallons per minute, as well as totalized flow in gallons.

3. The display unit shall have the capability of storing flow data that can be downloaded through a USB port to a flash drive or portable computer. Include software that allows the downloaded flow data to be stored in a spreadsheet where it can be analyzed, and used to generate graphs and reports.

4. Teledyne Isco Signature flowmeter and display, with Flowlink software, or equal.

X. SCADA

1. Relocate the existing Dakota Supply Group SCADA panel from the building in its entirety to inside the new lift station control panel enclosure, and reconnect it as shown in the Drawings.

2. Relocate the existing radio antenna from the building to the light pole provided under Section 26 5000, and furnish coaxial antenna cable to connect it to the radio in the SCADA panel.

3. The SCADA panel shall communicate with the existing master SCADA control panel and computer at the City offices in the same manner as it does presently. Refer to specification section 40 9000.

PART 3 – EXECUTION

3.01 GENERAL

A. The installation, inspection, start-up, adjustment, written report, guarantee, and operator training shall be as defined in the General Conditions in conjunction with this Section.

3.02 CALIBRATION, ADJUSTING AND TESTING

A. Devices requiring field calibration shall be calibrated in the presence of the Engineer=s representative and documented.

3.03 PROJECT MANAGEMENT

A. The Contractor shall provide engineering and administrative services necessary to fulfill the requirements of this Specification.

B. The Contractor shall provide the services of an experienced project manager as the overall coordinator during the course of the project.

3.04 INSTALLATION AND START UP

A. The Contractor shall install the lift station control panel, submersible level transducer, high/low level float switches, ultrasonic level transducer, antenna mast, antenna and antenna cable.

B. The Contractor shall provide a skilled instrumentation engineer or technician to complete troubleshooting and start-up to place the entire system into satisfactory operation. Inspect the completed installation, and make final field adjustments as required for start-up.

C. Demonstrate proper operation of all system features and functions to Owner and Engineer.

D. Coordinate installation and start-up scheduling with the Owner and Engineer.

E. Note that the existing lift station controls shall remain in operation for as long as possible during construction. Coordinate scheduling of the installation and startup of the new controls with the general contractor, utility provider, Owner and Engineer.

3.05 ACCEPTANCE TESTING

A. After the installation is complete, and proper operation has been demonstrated, a 60 day acceptance test shall begin. The entire system shall be required to operate for 60 days with no malfunctions, field repairable malfunctions excepted. Any malfunction during the 60 day test which cannot be corrected within 24 hours by the supplier shall be considered a non-field repairable malfunction and, after repairs are complete, the test shall be repeated.

B. The acceptance test shall apply to all equipment furnished under this Section.

C. Substantial Completion may be obtained prior to starting the acceptance test.

D. Final Completion shall not be considered prior to successful completion of the acceptance test.

3.06 TRAINING

A. Training on the lift station control panel shall be for four (4) hours, minimum.

3.07 PARTS AND SUPPLIES

A. Provide all expendable items inside the control panel such as lamps, fuses, etc. during system startup, checkout, and demonstration.

B. Trained personnel shall be available on a 24-hour notice with complete spare parts, maintenance items and stocks as may be required under any and all circumstances.

END OF SECTION 26 2419

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SECTION 26 3000 – STANDBY POWER GENERATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. A natural gas powered 60kW standby generator set will be purchased by the Owner under a separate contract.

B. Installation of the standby generator will be under the separate contract. Furnish and install conduits as shown in the drawings and specifications, wiring will be furnished and installed under the separate contract.

PART 2 – PRODUCTS – Not used

PART 3 - EXECUTION

3.01 PROVISIONS FOR INSTALLATION

A. The Contractor shall furnish and install a reinforced concrete pad for the generator set. The Contractor shall coordinate the concrete pad thickness and size with the generator supplier.

B. The Contractor shall furnish and install conduits from the control panel to the generator as shown in the Drawings. The wiring from the generator to the control panel will be furnished and installed under the separate contract.

C. Installation of natural gas service to the generator will be provided under the separate contract.

END OF SECTION 26 30 00

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SECTION 26 5000 – LIGHTING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Lighting fixture, lamp and appurtenances.

1.2 SUBMITTALS

A. Shop drawings and technical data in conformance with Division 00 and including:
   1. Fixture specification sheets
   2. Footcandle distribution curves

1.3 REFERENCES

A. National Fire Protection Association (NFPA)
   1. NFPA 70 National Electrical Code (NEC), 2017

B. Underwriters Laboratories (UL)
   1. UL 57 Electric Lighting Fixtures

PART 2 – PRODUCTS

2.1 FIXTURES

A. The fixture shall bear the seal of the Underwriters Laboratories (UL.) The seal shall be for the type of area the fixture is to be located in.

B. The fixture shall be of the LED type.

C. The fixture shall be complete with lamps, starters, diffusers, guards, clips, retainers, etc. in accordance with the drawings, specifications and ordinances governing the installation of the fixtures.

2.3 PHOTOCONTROLS

A. The yard light fixture shall be provided with a photocontrol sensor, to allow the light to automatically come on at dusk and turn off at dawn each day.

PART 3 – EXECUTION

3.1 GENERAL

A. The Contractor shall verify, prior to ordering the fixture, that the fixture bears the UL label and meets the requirements for the location where the fixture are to be installed.

B. The Contractor shall install the fixture in accordance with the manufacturer's recommendations and shall be mounted carefully and rigidly.

C. The fixture shall be connected into the power distribution system per the requirements of the National Electrical Code, the manufacturer's requirements, or the contract documents, whichever is more stringent.

END OF SECTION 26 5000

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SECTION 31 0513 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subsoil materials.
   2. Topsoil materials.

1.2 RELATED DOCUMENTS

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

B. Standard Specification: Minnesota Department of Transportation,"2018 Standard Specifications and all Supplemental Specifications. Measurement and payment provisions and safety program submittals included in the Minnesota Department of Transportation "Standard Specifications for Construction" do not apply to this Section.

C. Geotechnical Report: "Report of Geotechnical Exploration and Review, Proposed Lift Station, Cottonwood Minnesota" AET Project number 13-20496.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

B. Base Course: Aggregate layer placed between the sub-base course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated sub-grade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above sub-grade elevations and to lines and dimensions indicated.

G. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

H. Unauthorized Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.

I. Fill: Soil materials used to raise existing grades.

J. Final Backfill: Backfill placed over initial backfill to fill a trench.

K. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

L. Rock: (Omit)

M. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

N. Sub-base Course: Aggregate layer placed between the sub-grade and base course for hot-mix asphalt pavement, or aggregate layer placed between the sub-grade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

O. Sub-grade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, drainage course, or topsoil materials.

P. Subsoil: Site earthwork soil below the topsoil and base layer.

Q. Topsoil: Site top layer of site soil suitable for growing plants and turf.

R. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 SUBMITTALS

A. In accordance with Section 01 3300 – Submittal Procedures.

B. Materials Source: Submit source name, type of material and gradation reports of imported materials Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487 or MnDOT specified gradation requirements.
   2. Laboratory compaction curve according to ASTM D 698.

C. Manufacturer's Certificate: of supplied products indicating products meet or exceed specified requirements.

D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Qualification Data: For Testing Agency.

B. Furnish each subsoil and topsoil material from single source throughout Work.

C. Perform Work in accordance with the plans and specifications.

PART 2 - PRODUCTS

2.1 SUBSOIL MATERIALS

A. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter, with no more than 5% passing a #200 sieve.

B. Unsatisfactory Soils: Soil Classification [Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

C. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
   1. Conform to specified requirements.

2.2 TOPSOIL MATERIALS

A. Topsoil Type: Refer to Landscape Plans.

2.3 SOURCE QUALITY CONTROL

A. Testing and Analysis of Soil Material: Provide certified test results of material

B. Testing and Analysis of Topsoil Material: Provide certified test results of material

C. When tests indicate materials do not meet specified requirements, change material and retest.

D. Furnish materials of each type from same source throughout Work.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated subsoil and topsoil not intended for reuse, from Site.

D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from Site.

3.2 STOCKPILING

A. Stockpile materials on Site at locations designated by Owner.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile topsoil a maximum 8' high or ad directed by the Owner.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

H. Cover to prevent windblown dust.

I. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

J. Refer to Erosion Control prior to grading the Contractor shall install the erosion-control measures as identified on the erosion control plan and SWPPP plan to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, pavements and walkways and tracking of sediment onto streets

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade Site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade Site surface to prevent free standing surface water.

END OF SECTION 31 0513

SECTION 31 0516 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Coarse aggregate materials.
   2. Fine aggregate materials.
   3. Granular materials.

1.2 RELATED DOCUMENTS

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

B. Standard Specification: Minnesota Department of Transportation,"2018 Standard Specifications and all Supplemental Specifications. Measurement and payment provisions and safety program submittals included in the Minnesota Department of Transportation "Standard Specifications for Construction" do not apply to this Section.

C. Geotechnical Report: "Report of Geotechnical Exploration and Review, Proposed Lift Station, Cottonwood Minnesota" AET Project number 13-20496."

1.3 SUBMITTALS

A. Materials Source: Name type of material and gradation reports as specified of imported materials suppliers.

B. Manufacturer's Certificate: Aggregate material meets or exceeds State Department of Transportation Specifications.

1.4 QUALITY ASSURANCE

A. Qualification Data: For Testing Agency

B. Furnish each aggregate material from single source throughout Work.

C. Perform Work in accordance with the Plans and Specifications.

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

A. Refer to aggregate type indicated on the Plans.

B. Conform to MnDOT Gradation Specifications for type of aggregate or granular material specified.

2.2 SOURCE QUALITY CONTROL

A. Testing and Analysis: Provide certified test results of material

B. When tests indicate materials do not meet specified requirements, change material and retest.

C. Furnish materials of each type from same source throughout Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is dry and ready to support paving and imposed loads.

B. Proof-roll subgrade with fully loaded tandem dump truck in minimum two passes to identify soft spots.

C. Remove soft substrate and replace with compacted fill.

D. Verify subgrade has been inspected, gradients and elevations are correct.

3.2 PREPARATION

A. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.

B. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

C. Do not place fill on soft, muddy, or frozen surfaces.

D. Remove excess excavated coarse aggregate materials and fine aggregate materials not intended for reuse, from Site.

E. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from Site.

3.3 STOCKPILING

A. Stockpile materials on Site at locations designated by Owner.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

F. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

G. Refer to Erosion Control prior to grading the Contractor shall install the erosion-control measures as identified on the erosion control plan and SWPPP plan to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, pavements and walkways and tracking of sediment onto streets

3.4 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade Site surface to prevent free-standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 31 0516

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SECTION 31 1000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing surface debris.
   2. Protecting existing vegetation to remain
   3. Remove and Grub designated trees, shrubs, and other plant life.

1.2 RELATED DOCUMENTS

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

B. Standard Specification: Minnesota Department of Transportation,"2018 Standard Specifications and all Supplemental Specifications. Measurement and payment provisions and safety program submittals included in the Minnesota Department of Transportation "Standard Specifications for Construction" do not apply to this Section.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on the Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

A. Product Data: Herbicide; indicate compliance with applicable codes for environmental protection.

B. Informational Submittals

1. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing and construction.
2. Use sufficiently detailed photographs or videotape.
3. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
4. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.5 QUALITY ASSURANCE

A. Conform to State and Local codes for environmental requirements, disposal of debris, burning debris on Site and use of herbicides.

B. Pre-construction conference: Conduct conference at Project site.

C. Perform Work in accordance with the Plans and Specifications.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
   3. Prepare and coordinate traffic and pedestrian control plans with the authorities having jurisdiction.

B. Improvements on Adjoining Property: The Contractor shall limit the construction activity to the Owners property.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed by Owner.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control and plant and landscape protection measures are in place.

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Herbicide: as approved by authority having jurisdiction.

B. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 0513 "Soils for Earthwork."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing plant life designated to remain is tagged or identified.

B. Identify waste area and salvage area for placing removed materials.

3.2 PREPARATION

A. Contact local utility companies before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain from damage.

B. Protect benchmarks, survey control points, and existing structures from damage or displacement.

C. Protect trees and other natural vegetation within the project and/or adjacent as designated on the Plans
   1. Exercise extreme caution in working adjacent to trees. Should any portion of the tree branches require removal to permit operation of the Contractor's equipment engage the services of a professional tree trimming service to trim the trees prior to the beginning of operation.
   2. Broken limbs will be removed, immediately and cuts shall be properly protected to minimize any lasting damage to the tree.
   3. No trees will be removed without authorization by the Owner.
   4. Costs for tree trimming services is incidental.

3.4 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Erosion and Sedimentation Control Plans, SWPPP Manual and the requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion and sedimentation control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, stone piles, debris piles, small structures, trees, shrubs, and other vegetation as indicated on the Plans or to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Completely remove stumps and remove roots, obstructions, and debris.
   3. Use only hand methods for grubbing within protection zones.
   4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.6 CLEARING

A. Clear areas required for access to Site and execution of Work.

B. Remove trees and shrubs within marked areas, or as indicated on the Plans. Remove stumps and grub main root ball.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

3.7 REMOVAL

A. Remove debris, stone piles, debris piles, small structures, trees, and extracted plant life from Site.

B. Continuously clean-up and remove waste materials from Site. Do not allow materials to accumulate on Site.

C. Do not burn or bury materials on Site. Leave Site in clean condition.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Comply with Minnesota Department of Natural Resources and Minnesota Department of Agriculture regulations and MnDOT 2101 for removing, transporting and disposal of quarantined and invasive tree and brush species.

END OF SECTION 31 1000

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SECTION 31 2213 - ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Topsoil excavation and salvage.
   2. Excavating subsoil.
   3. Cutting, grading, filling, rough contouring, compacting site for building pads, tank foundations and pavements.

1.2 RELATED DOCUMENTS

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

B. Standard Specification: Minnesota Department of Transportation,"2018 Standard Specifications and all Supplemental Specifications. Measurement and payment provisions and safety program submittals included in the Minnesota Department of Transportation "Standard Specifications for Construction" do not apply to this Section.

C. Geotechnical Report: "Report of Geotechnical Exploration and Review, Proposed Lift Station, Cottonwood Minnesota" AET Project number 13-20496.

1.3 SUBMITTALS

A. Samples: If requested by Owner, submit samples in air-tight containers, 10 lb. samples of each type of soil to testing laboratory.

B. Materials Source: Submit source name and type of material and gradation reports of imported materials. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487 or MnDOT specified gradation requirements.
   2. Laboratory compaction curve according to ASTM D 698.

C. Manufacturer's Certificate: of supplied products indicating products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Qualification Data: For Testing Agency.

B. Furnish each type of soil material from single source throughout Work.

C. Perform Work according to the Plans and Specifications

PART 2 - PRODUCTS

2.1 MATERIALS

A. Subsoil: as specified in Section 31 0513, Soils for Earthwork.

B. Structural Soil: as specified in Section 31 0516, Aggregates for Earthwork.

C. Granular Soil: as specified in Section 31 0516, Aggregates for Earthwork.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify survey benchmark and intended elevations for Work are as indicated.

3.2 PREPARATION

A. Refer to Plans.

B. Refer to Geotechnical Report for earthwork, grading construction and recommendations.

C. Refer to Section 31 2500, Erosion Control. Prior to grading the Contractor shall install the erosion-control measures as identified on the erosion control plan and SWPPP plan to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, pavements and walkways and tracking of sediment onto streets.

D. Verify permit approvals have been received from the State and local agencies having jurisdiction for construction permits.

E. Contact local utility line information service before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Do not begin excavations until existing utilities are located and marked.

F. Identify required lines, levels, contours, and datum.

G. Notify utility company(s) to remove and/or relocate utilities.

H. Protect utilities indicated to remain from damage.

I. Protect plant life, lawns, and other features remaining as portion of final landscaping.

J. Protect benchmarks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 GENERAL

A. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Provide a smooth transition between adjacent existing grades and new grades.

C. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

D. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish sub-grades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus 0 inch or Minus 1/2 inch.
   3. Pavements: Plus 0 inch or Minus 1 inch.
   4. Grading inside Building Lines: Finish sub-grade to a tolerance of 1/2 inch of finished subgrade elevation when tested with a 10-foot (3-m) straightedge.

3.4 TOPSOIL EXCAVATION AND SALVAGE

A. Excavate and salvage topsoil from areas to be excavated or fill is to be placed.

B. Stockpile in areas designated on the Plans or as directed by the Engineer.

C. Salvage the quantity of topsoil for re-spreading to the depth indicated on the plans.

D. Spread excess topsoil in non-structural areas as directed by the Engineer.

3.5 SUBSOIL EXCAVATION

A. Excavate in place subsoil fill that does not meet compaction requirements. Remove unsuitable fill and replace with suitable fill compacted to specified requirements. Remove to natural soil if required.

B. Excavate subsoil from areas to be further excavated, re-landscaped, or regraded. marked areas. or as indicated on the Plans.

C. When excavating through roots, perform Work by hand and cut roots with sharp axe.

D. Remove excess subsoil not intended for reuse, from Site.

E. Benching Slopes: Horizontally bench existing slopes greater than 1: 4 to key placed fill material to slope to provide firm bearing.

F. Stability: Replace damaged or displaced subsoil as specified for fill.

3.6 FILLING

A. Verify subsoil meets compaction requirements. .

B. Fill areas to contours and elevations with unfrozen, suitable materials.

C. Place material in continuous layers as follows:
   1. Subsoil Fill: Maximum 8 inches compacted depth.
   2. Structural/Pavement Fill: Maximum 6 inches compacted depth.
   3. Granular Base Fill: Maximum 6 inches compacted depth.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from building minimum 10 percent slope for minimum distance of 10 feet unless noted otherwise.

F. Make grade changes gradual. Blend slope into level areas.

G. Repair or replace items indicated to remain damaged by excavation or filling.

3.7 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot from required elevation.

3.8 FIELD QUALITY CONTROL

A. Perform inspection of excavation and controlled fill operations in accordance with the plans and specifications.

B. Request visual inspection of bearing surfaces by Owner and Owner's Inspection Agency before installing subsequent Work.

C. Perform soil density testing by Soils Engineer as specified. Do not proceed with structure construction until density tests are reviewed and approved by the Owner. Perform tests at the locations and frequencies determined by the Soils Engineer.

D. Compact soils to achieve the required density requirements.
   1. Comply with Section 01 4000, Quality Requirements.

E. Compaction Density Frequency Requirements:
   1. Comply with Section 01 4000, Quality Requirements.

F. Allow testing agency to inspect and test sub-grades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

G. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

H. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

I. Proof roll compacted fill surfaces under slabs-on-grade, pavers, paving, and.

J. Proof-roll sub-grade pavements with a pneumatic-tired tandem-axle dump truck with a gross weight of not than 25 tons to identify soft pockets and areas of excess yielding.

K. Completely proof-roll sub-grade in one direction, repeating proof-rolling in direction perpendicular to first direction]. Limit vehicle speed to 3 mph.

L. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Soils Engineer and replace with compacted backfill or fill as directed.

M. Proof roll shall be observed by the Soils Engineer.

N. Replace all sub-grade soil disturbed during construction that has become unsuitable and unsatisfactory or cannot pass a test roll. Remove unsuitable soil from site and import suitable soil at no additional cost to the Owner.

3.1 PROTECTION OF FINISHED WORK

Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION 31 2213

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SECTION 31 2316 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil densification.
   2. Excavating for foundations.
   3. Excavating for paving, roads, and parking areas.
   4. Excavating for slabs-on-grade.
   5. Excavating for Site structures.
   6. Excavating for landscaping.

1.2 RELATED DOCUMENTS

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

B. Standard Specification: Minnesota Department of Transportation,"2018 Standard Specifications and all Supplemental Specifications. Measurement and payment provisions and safety program submittals included in the Minnesota Department of Transportation "Standard Specifications for Construction" do not apply to this Section.

C. Geotechnical Report: "Report of Geotechnical Exploration and Review, Proposed Lift Station, Cottonwood Minnesota" AET Project number 13-20496.

D. Occupational Safety and Health Administration (OSHA): 29CFR, PART 126, latest Edition.
   a. Perform Construction in accordance with OSHA Laws and Requirements.
   b. Excavations must comply with the requirements of OSHA 29 CFR PART 2926, Subpart P; Excavations and Trenches.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

B. Excavation: Removal of material encountered above sub-grade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions as directed by Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
   3. Unauthorized Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation

1.4 SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

B. Samples: If requested, submit samples in air-tight containers, 10 lb. samples of each type of soil to testing laboratory.

C. Materials Source: Submit source name and type of material and gradation reports of imported materials. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487 or MnDOT specified gradation requirements.
   2. Laboratory compaction curve according to ASTM D 698.

D. Manufacturer's Certificate: Of supplied products indicating products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Qualification Data: For Testing Agency.

B. Furnish each type of soil material from single source throughout Work.

C. Perform Work according to the Plans and Specifications

D. For shoring construction: Prepare excavation and shoring protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Minnesota.

PART 2 - PRODUCTS - Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify survey benchmark and intended elevations for Work are as indicated.

3.2 PREPARATION

A. Refer to Drawings.

B. Refer to Geotechnical Report for earthwork, grading construction and recommendations.

C. Refer to Erosion Control Plan. Prior to grading the Contractor shall install the erosion-control measures as identified on the Erosion Control Plan and SWPPP Plan to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, pavements and walkways and tracking of sediment onto streets.

D. Verify permit approvals have been received from the State and local agencies having jurisdiction for construction permits.

E. Contact local utility line locating service to coordinate underground utility line locations.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Do not begin excavations until existing utilities are located and marked.

F. Identify required lines, levels, contours, and datum.

G. Notify utility company to remove and/or relocate utilities.

H. Protect utilities indicated to remain from damage.

I. Protect plant life, lawns, and other features remaining as portion of final landscaping.

J. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

3.3 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation Work.

B. Excavate subsoil to accommodate pile installation, building foundations, structural slabs, slabs-on-grade, paving, and site structures, construction operations, and other project construction activities.

C. Excavations for Footings and Foundations: Do not disturb bottom of excavation intend as bearing surface. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work with a tolerance of 0 inch plus and 1- inch minus.

D. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of 0 “plus or 1- inch minus. Do not disturb bottom of excavations intended as bearing surfaces.

E. Excavate to working elevation for piling Work.

F. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity or greater as specified.

G. Slope excavations to OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, Excavations requirements and existing soils conditions.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation.

I. Trim excavation. Remove loose matter.

J. Remove lumped subsoil, boulders and rock.

K. Notify Soils Engineer of unexpected subsurface conditions.

L. Correct areas over excavated with as directed by Soils Engineer.

M. Remove excess and unsuitable material from Site.

N. Repair or replace items indicated to remain damaged by excavation.

O. Incorporate all excavated soils that are suitable for fill and embankment grading into the project

3.4 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared sub-grades, and from flooding Project site and surrounding area.

B. Obtain permits from agencies having jurisdiction. The Contractor shall comply with the dewatering requirements of the State and local agencies having jurisdiction.

C. Protect sub-grades from softening, undermining, washout, and damage by rain or water accumulation.

D. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

E. Install a dewatering system to keep sub-grades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and sub-grades.

3.6 SUBGRADE INSPECTION

A. Notify Soils Engineer when excavations have reached required sub-grade.

B. Excavate to indicated elevations and dimensions within a tolerance of plus 0 inches or minus 1 inch. Ex-tend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

C. If Soils Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed by the Soils Engineer.

3.7 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, sub-drainage, damp proofing, waterproof-ing and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.

4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
8. Place backfill on sub-grades free of mud, frost, snow, or ice.

B. SOIL MOISTURE CONTROL
1. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
2. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
3. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

C. COMPACTION OF SOIL BACKFILLS
1. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
2. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
3. Compact soil materials to not less than the percentages of maximum dry unit weight specified.
4. Take care to prevent damage to foundation or structure walls from compacting.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation.
1. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Owner.
2. Correct unauthorized excavation at no cost to the Owner.

B. Fill unauthorized excavations under other construction, pipe, or conduit.

3.9 FIELD QUALITY CONTROL

A. Perform inspection of excavation and controlled fill operations in accordance with the Drawings and Specifications. Coordinate inspection schedule with Owner and Soils Engineer.

B. Request visual inspection of bearing surfaces by Owner and inspection agency before installing subsequent Work.

C. Perform soil density testing by Soils Engineer as specified. Do not proceed with improvement, or structure construction until density tests are reviewed and approved by the Owner.

D. Allow testing agency to inspect and test sub-grades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

E. Footing Sub-grade: Testing and frequency of tests to be determined by Soils Engineer.

F. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

G. All retesting of failed tests will be at the Contractor's expense.

H. Refer to Section 01 4000 Quality Requirements, for compaction and testing frequency requirements.

I. Replace all sub-grade soil disturbed during construction that has become unsuitable and unsatisfactory or cannot pass a test roll. Remove unsuitable soil from site and replace with suitable soil at no additional cost to the Owner.

3.10 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundations and pavements from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

D. Protect and maintain erosion and sedimentation controls during earth moving operations.

E. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth, reshape and re-compact.

F. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality and condition of finished surfacing to match adjacent work and eliminate evidence of restoration.

G. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste soils, including unsatisfactory soil, trash and debris and legally dispose of them off Owner's property. Coordinate with Owner.
   1. If directed by the Owner, transport surplus satisfactory soil to designated areas on Owner's property for stockpiling or spreading.

END OF SECTION 31 2316

SECTION 31 2316.13 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating trenches for utilities.
   2. Compacted fill from utility pipe bedding to subgrade elevations.

1.2 RELATED DOCUMENTS

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

B. Standard Specification: Minnesota Department of Transportation,"2018 Standard Specifications and all Supplemental Specifications. Measurement and payment provisions and safety program submittals included in the Minnesota Department of Transportation "Standard Specifications for Construction" do not apply to this Section.

C. Geotechnical Report: "Report of Geotechnical Exploration and Review, Proposed Lift Station, Cottonwood Minnesota" AET Project number 13-20496.

D. Occupational Safety and Health Administration (OSHA): 29CFR, PART 126, latest Edition.
   a. Perform Construction in accordance with OSHA Laws and Requirements.
   b. Excavations must comply with the requirements of OSHA 29 CFR PART 2926, Subpart P; Excavations and Trenches.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

B. Bedding Course: Aggregate layer placed over the excavated sub-grade in a trench before laying pipe and around the pipe.

C. Common Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Final Backfill: Backfill placed over initial backfill to fill a trench.

E. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

F. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 SUBMITTALS

A. Excavation Protection Plan: If requested by Owner. Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

B. Product Data: Geotextile fabric indicating fabric and construction.

C. Materials Source: Name and type of material and gradation reports as specified of imported materials source. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487 or MnDOT specified gradation requirements.
   2. Laboratory compaction curve according to ASTM D 698:

D. Manufacturer's Certificate: of supplied products indicating products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Qualification Data: For Testing Agency.

B. Perform Work in accordance with the Plans and Specifications

C. For shoring construction: Prepare excavation and shoring protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Minnesota.

1.6 FIELD MEASUREMENTS

A. Verify field measurements and elevations prior to construction.

1.7 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

B. Coordinate work with the work of other contractors.

PART 2 - PRODUCTS

2.1 TRENCH BACKFILL MATERIALS

A. Subsoil Backfill: Utilize satisfactory trench excavation material for backfilling the trench. Refer to Section 31 0513, Soils for Earthwork, for soil types.

B. Remove unsatisfactory trench excavation material and replace with satisfactory material Refer to Section 31 0513, Soils for Earthwork, for soil types.

C. Aggregate Bedding: Refer to Bedding type indicated on the Plans. Conform to MnDOT Specification 3149.

D. Concrete:
   1. Lean concrete.

E. Refer to Plans for pipe bedding details and utility constructions requirements.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable. Refer to plans for Geotextile type indicated on the Plans. Conform to MnDOT Specification 3733.

B. Warning Tape and Markers: (OMIT)

PART 3 - EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated.
   1. Owner may make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Refer to Geotechnical Report for earthwork, grading and trenching construction requirements and recommendations.

B. Refer to Erosion Control Plan. Prior to grading the Contractor shall install the erosion-control measures as identified on the Erosion Control Plan and SWPPP Plan to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, pavements and walkways and tracking of sediment onto streets.

C. The Contractor shall verify permit approvals have been received from the State and local agencies having jurisdiction for construction permits.

D. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by utility pipe trenching operations.

E. Install dewatering measures as required for the trench excavation and pipe installation.

F. Field verify location of active an inactive utility lines prior to construction.

G. Contact local utility agency prior to construction.to coordinate connection to agencies utility pipe. Perform pipe connection in accordance with the requirements of the agency having jurisdiction.

H. Contact local utility line locating service to coordinate underground utility line locations.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Do not begin excavations until existing utilities are located and marked.

I. Identify required lines, levels, contours, and datum locations.

J. Protect plant life, lawns, and other features remaining as portion of final landscaping.

K. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

L. Maintain and protect above and below grade utilities indicated to remain.

M. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Remove lumped subsoil, boulders, and rock

C. Do not advance open trench more than two pipe lengths ahead of installed pipe.

D. Cut trenches sufficiently wide to enable installation, allow inspection. Remove water or materials that interfere with Work.

E. Slope excavations to OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, Excavations requirements and existing soils conditions.

F. Excavate bottom of trenches as indicated on the Plan Bedding Details.

G. Excavate trenches to depth indicated on the Plans. Provide uniform and continuous bearing and support for bedding material and utilities.

H. When Project conditions permit, slope side walls of excavation, per OSHA requirements, starting above top of pipe, refer to plan pipe bedding details. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this Section.

I. Notify Soils Engineer, and request instructions when unsuitable pipe bedding subgrade is encountered.

J. Cut out soft areas of subgrade not capable of compaction in place. Backfill with satisfactory material and compact to density equal to or greater than requirements for subsequent backfill material.

K. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

L. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Soils Engineer.

M. Remove excess subsoil not intended for reuse, from Site.

N. Stockpile excavated material in area designated on Site according to Section 31 0513.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation Work.

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Repair damage caused by failure of sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

F. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared sub-grades, and from flooding Project site and surrounding area.

B. Obtain permits from agencies having jurisdiction. The Contractor shall comply with the dewatering requirements of the Minnesota DNR grading permit and agencies having jurisdiction.

C. Protect sub-grades from softening, undermining, washout, and damage by rain or water accumulation.

D. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

E. Maintain dewatering until no longer required.

3.6 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Place geotextile fabric as indicated on the Plans

D. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

F. Compact soil materials to not less than the percentages of maximum dry unit weight specified.

G. Place material in continuous layers as follows:
   1. Subsoil Fill: Maximum 8 inches compacted depth.
   2. Structural Fill: Maximum 6 inches compacted depth.
   3. Granular Fill: Maximum 6 inches compacted depth.

H. Employ placement method that does not disturb or damage foundation perimeter drainage, utilities in trench and subsurface drainage pipe.

I. Maintain optimum moisture content of fill materials to attain required compaction density.

J. Do not leave trench open at end of working day.

K. Trench Safety: Monitor and protect open trench during working hours.

L. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below sub-grade under pavements and slabs. Refer to Utility Sections.

3.7 TOLERANCES

A. Top Surface of Backfilling under Paved Areas: Plus or minus 0 inches. 1 inch. Refer to Plans for subgrade elevations.

B. Top Surface of General Backfilling: Plus or minus 2”+/- from required elevations. Grade to promote drainage

3.8 FIELD QUALITY CONTROL

A. Perform inspection of excavation and controlled fill operations in accordance with the plans and specifications.

B. Request visual inspection of bearing surfaces by Soils Engineer and inspection agency before installing subsequent Work.

C. Perform soil density compaction testing at the direction of the Soils Engineer.

D. Compact trench backfill by “Quality Compaction”, MnDOT Specification 2105.3.F.2 to achieve the required densities.

E. Compaction Density Requirements:
   1. Refer to Section 01 4000, Quality Requirements.

F. Compaction Density Frequency Requirements:
   1. Refer to Section 01 4000, Quality Requirements.

G. Allow testing agency to inspect and test sub-grades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

H. Tests will be performed at the locations and elevations as determined by the Soils Engineer:

I. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

J. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

K. All retesting of failed tests will be at the Contractor's expense.

3.9 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

B. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

C. Protect and maintain erosion and sedimentation controls during trenching operations.

D. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

E. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality and condition of finished surfacing to match adjacent work and eliminate evidence of restoration.

F. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.1 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste soils, including unsatisfactory soil, trash and debris and legally dispose of them off Owner's property. Coordinate with Engineer.

3.2 If directed by the Engineer, transport surplus satisfactory soil to designated areas on Owner's property for stockpiling or spreading.

END OF SECTION 31 2316.13

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SECTION 31 2323 - FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Backfilling building perimeter to subgrade elevations.
   2. Backfilling Site structures to subgrade elevations.
   3. Embankment Grading
   4. Fill under slabs-on-grade.
   5. Fill under paving.

1.2 RELATED DOCUMENTS

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

B. Standard Specification: Minnesota Department of Transportation, "2018 Standard Specifications and all Supplemental Specifications. Measurement and payment provisions and safety program submittals included in the Minnesota Department of Transportation "Standard Specifications for Construction" do not apply to this Section.

C. Geotechnical Report: "Report of Geotechnical Exploration and Review, Proposed Lift Station, Cottonwood Minnesota" AET Project number 13-20496.

D. Geotechnical Report: "Report of Geotechnical Exploration, Main Lift Station Improvements", American Engineering Testing, Inc, February 2020. Report No.

1.3 DEFINITIONS

A. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

B. Fill: Soil materials used to raise existing grades.

C. Final Backfill: Backfill placed over initial backfill to fill a trench.

1.4 SUBMITTALS

A. Product Data: Geotextile fabric indicating fabric and construction.

B. Materials Source: Submit source name and type of material and gradation reports of imported materials. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487 or MnDOT specified gradation requirements.
   2. Laboratory compaction curve according to ASTM D 698.

C. Manufacturer's Certificate: of supplied products indicating products meet or exceed specified requirements

1.5 QUALITY ASSURANCE

A. Furnish each soil type and topsoil material from single source throughout Work.

B. Perform Work according to the Plans and Specifications.

C. Density testing by Soils Engineer engaged by Owner.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter, with no more than 5% passing a #200 sieve.

B. Borrow Materials: Refer to Plans for common borrow type. Conform to MnDOT Specification 2105.2.

C. Subbase and Base Aggregates: Refer to Section 31 0516, AGGREGATES FOR EARTHWORK.

D. Concrete:
   1. Lean concrete.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven.

B. Provide Geotextile Fabric Type as indicated on the Drawings. Conform to MnDOT Specification 3733.

PART 3 - EXECUTION

3.1 PREPARATION

A. Refer to plans.

B. Refer to Geotechnical Report for earthwork, grading construction and compaction requirements and recommendations.

C. Refer to Section 31 2500, Erosion and Sedimentation Controls. Prior to grading the Contractor shall install the erosion-control measures as identified on the Erosion Control Plan and SWPPP Plan to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, pavements and walkways and tracking of sediment onto streets.

D. Verify permit approvals have been received from the State and local agencies having jurisdiction for construction permits

E. Contact local utility line locating service to coordinate underground utility line locations.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Do not begin excavations until existing utilities are located and marked.

F. Identify required lines, levels, contours, and datum.

G. Notify utility company to remove and/or relocate utilities.

H. Protect utilities indicated to remain from damage.

I. Protect plant life, lawns, and other features remaining as portion of final landscaping.

J. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

3.2 SUGRADE PREPARATION

A. Compact subgrade to density requirements for subsequent back fill materials.

B. Cut out soft areas of subgrade not capable of compaction in place and replace Backfill with required fill material and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 6” or as directed by Soils Engineer compact and perform density testing

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Place geotextile fabric as indicated on the Plans.

D. Place fill material in continuous layers and compact.
   1. Subsoil Fill: Maximum 8 inches compacted depth.
   2. Structural Fill: Maximum 6 inches compacted depth.
   3. Granular Fill: Maximum 6 inches compacted depth.

E. Employ placement method that does not disturb or damage other Work.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Backfill against supported foundation walls. Do not backfill against unsupported foundation walls.

H. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

I. Compact soil materials to not less than the following percentages of maximum dry unit weight specified.

J. Slope grade away from building minimum 10 percent slope for minimum distance of 10 feet, unless noted otherwise.

K. Make gradual grade changes. Blend slope into level areas.

L. Remove surplus backfill materials from Site.

M. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Fill embankment for Footings and Foundations: Do not disturb bottom of intended bearing surface. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work with a tolerance of 0 inch plus and 1- inch minus.

B. Fill embankment for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Construct embankment to elevations and dimensions indicated within a tolerance of 0 “plus or 1- inch minus. Do not disturb bottom of excavations intended as bearing surfaces.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations. Grade to promote drainage.

3.5 FIELD QUALITY CONTROL

A. Perform inspection of excavation and controlled fill operations in accordance with the plans and specifications. Coordinate inspection schedule with Soils Engineer.

B. Request visual inspection of bearing surfaces by Soils Engineer and inspection agency before installing subsequent Work.

C. Perform soil density testing by Soils Engineer as specified. Do not proceed with structure construction until density tests are reviewed and approved by the Owner. Perform tests at the locations and frequencies determined by the Soils Engineer.

D. Compact soils in accordance with MnDOT Specification 2105.3 to achieve the required density requirements.

E. Compact soils to achieve the required density requirements.
   1. Comply with Section 01 4000, Quality Requirements.

F. Compaction Density Frequency Requirements:
   1. Comply with Section 01 4000, Quality Requirements.

G. Perform soil density testing by Soils Engineer as specified. Do not proceed with structure Allow testing agency to inspect and test sub-grades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

H. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

I. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

J. Proof roll compacted fill surfaces under slabs-on-grade, pavers, paving, and sidewalks. Proof roll must be observed by the Soils Engineer.

K. Proof-roll with a pneumatic-tired tandem-axle dump truck with a gross weight of not than 25 tons to identify soft pockets and areas of excess yielding.

L. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Soils Engineer and replace with compacted backfill or fill as directed.

M. Replace all sub-grade soil disturbed during construction that has become unsuitable and unsatisfactory or cannot pass a test roll. Remove unsuitable soil from site and replace with suitable soil at no additional cost to the Owner.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION 31 2323

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32 9200 Turf Grasses and Sod

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SECTION 32 1123 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aggregate base course construction for pavements and curb and gutter.

1.1 RELATED DOCUMENTS

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

B. Standard Specification: Minnesota Department of Transportation,"2018 Standard Specifications and all Supplemental Specifications. Measurement and payment provisions and safety program submittals included in the Minnesota Department of Transportation "Standard Specifications for Construction" do not apply to this Section.

C. Geotechnical Report: "Report of Geotechnical Exploration and Review, Proposed Lift Station, Cottonwood Minnesota" AET Project number 13-20496.

1.2 SUBMITTALS

A. Product Data:
1. Geotextile fabric.

B. Samples: If requested by the Owner submit sample in air-tight containers, 10 lb. sample of each type of aggregate fill to testing laboratory.

C. Materials Source: Name of aggregate and granular material suppliers.

D. Manufacturer's Certificate: Aggregate and granular material meets or exceeds State Department of Transportation Specifications.

1.3 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout Work.

B. Perform Work in accordance with Mn/DOT specifications where specified.

C. Perform Work in accordance with the Drawings and Specifications.

PART 2 - PRODUCTS

2.1 GRANULAR MATERIAL

A. Refer to Type indicated on the Drawings.

B. Granular Material: Comply with MnDOT Specification 3149.2.B.

C. Select Granular Material: Comply with MnDOT Specification 3149.2.B.

2.2 AGGREGATE MATERIALS

A. Refer to aggregate type indicated on the Plans.

B. Conform to MnDOT Specification 3138.

2.3 RECYCLED AGGREGATE MATERIALS

A. Recycled Base: Comply with MnDOT Specification 3138.

B. Recycled material not permitted in Class Surface Aggregate.

2.4 ACCESSORIES

A. Furnish Type of Geotextile indicated on the Plans: Non-biodegradable, woven**.** Comply with MnDOT Specification 3733.

B. Herbicide: OMIT

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Proof-roll substrate with fully loaded tandem dump truck in minimum two passes to identify soft spots.
   2. Remove soft substrate and replace with compacted fill.

B. Refer to Geotechnical Report for earthwork, grading construction recommendations.

C. Verify substrate has been inspected, gradients and elevations are correct.
   1. Do not proceed with granular borrow or aggregate base until a test roll has been performed and approved by the Soil's Engineer.

3.2 PREPARATION

A. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.

B. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

C. Do not place fill on soft, muddy, or frozen surfaces.

D. Remove excess excavated aggregate materials and not intended for reuse, from Site.

E. Remove excavated materials not meeting requirements for aggregate materials and from Site.

3.3 STOCKPILING

A. Stockpile materials on Site at locations designated by Owner.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

F. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

G. Refer to Erosion Control Plan prior to grading the Contractor shall install the erosion-control measures as identified on the Erosion Control Plan to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, pavements and walkways and tracking of sediment onto streets

3.4 SUBBASE AND AGGREGATE BASE PLACEMENT

A. Subbase Construction: Refer to Section 31 2316 Excavation.

B. Place aggregate equal thickness layers to total compacted thickness as shown on the Plans.
1. Maximum Layer Compacted Thickness: 6 inches.

C. Roller or vibratory (sheep's foot) compact subbase to densely compact subbase.

D. Roller compact aggregate base to densely compact aggregate.

E. Level and contour surfaces to elevations, profiles, and gradients indicated.

F. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.

G. Maintain optimum moisture content of fill materials to attain specified compaction density.

H. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.5 SUBGRADE, GRANULAR BASE AND AGGREGATE BASE COMPACTION

A. Aggregate and Granular Base Compaction:

1. Aggregate: Roller Compacted according to the Soils Engineer.
2. Granular: !00% Standard Proctor Density all depths.

B. Subgrade Compaction Requirements:
1. Subgrade: Upper 3 feet, 100% Standard Proctor Density.

C. Aggregate Base Sample Testing:
1. Obtain random samples of the aggregate base for gradation testing. Unless directed otherwise by the Soils Engineer, a minimum of 2 samples per 3,000 square yards of parking lot surface shall be obtained, or two samples per 1,000 linear feet of street.

D. Prior to placement of the aggregate base, the Engineer will require the completion of a test roll on the street subgrade. Perform test roll in the presence of the Engineer. Provide a loaded tandem axle truck with a gross weight of 25 tons.
   a. Test roll at the direction of the Soils Engineer. The Soils Engineer will determine which sections of the parking lot or street are unstable. Correction of the subgrade soils may be required.
   b. Cost for test rolling is incidental.

3.6 GEOTEXTILE PLACEMENT

A. Install geotextile fabric over subgrade according to manufacturer's instructions.

B. At locations shown on the Plans or as directed by the Soils Engineer.

C. Lap ends and edges.

D. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.

3.7 TOLERANCES

A. Maximum Variation from Flat Surface: 0 inch plus, 1/2 inch minus measured with 10 foot straight edge.

B. Maximum Variation from Course Thickness: 0-inch minus, 1/2 inch plus.

C. Maximum Variation from Elevation: 1/2 inch

3.1 FIELD QUALITY CONTROL

A. Perform inspection of aggregate base construction in accordance with the Plans and Specifications.

B. Request visual inspection of bearing surfaces by Soils Engineer and inspection agency before installing subsequent Work.

C. Perform soil density testing by Soils Engineer as specified. Do not proceed with structure construction until density tests are reviewed and approved by the Owner.

D. Allow testing agency to inspect and test aggregate base layers. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

E. Tests will be performed at locations and frequencies as determined by the Soils Engineer:

F. When testing agency reports that base courses have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace base material to depth required; re-compact and retest until specified compaction is obtained.

G. When tests and or visual observation by the Soils Engineer indicates the Work does not meet specified requirements, remove Work, replace, compact, and retest.

H. All retesting of failed tests will be at the Contractor's expense.

I. When requested by the Owner; proof roll compacted subgrade, aggregate coarse under slabs on-grade, pavers, pavement, and sidewalks. Proof roll must be observed by the Soils Engineer.

J. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Soils Engineer and replace with compacted backfill or fill as directed.

K. Replace all aggregate base and subgrade soil disturbed during construction that has become unsuitable and unsatisfactory or cannot pass a test roll. Remove unsuitable soil from site and replace with suitable soil at no additional cost to the Owner.

END OF SECTION 32 1123

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SECTION 32 9200 - TURF GRASSES AND SOD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Seeding.
   2. Sodding.

1.2 RELATED DOCUMENTS

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

B. Standard Specification: Minnesota Department of Transportation,"2018 Standard Specifications and all Supplemental Specifications. Measurement and payment provisions and safety program submittals included in the Minnesota Department of Transportation "Standard Specifications for Construction" do not apply to this Section.

C. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.
   1. American National Standards Institute (ANSI):
      a. ANSI Z60.1 - American Standard for Nursery Stock.
   2. ASTM International (ASTM):
      a. ASTM D5268 - Topsoil used for Landscaping Purposes.
      b. ASTM C602 - Agricultural Liming Materials.
   3. Erosion Control Technology Council (ECTC):
      a. Standard Specification for Rolled Erosion Control Products.

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and v

F. iruses.

G. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

H. Subgrade: Surface or elevation of subsoil remaining after excavation is complete or top surface of a fill or backfill before planting soil is placed.

I. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

J. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

A. Submittal Process: Submit in accordance with Section 01330 - Submittal Procedures.
   1. Clearly mark to identify pertinent products used on site. Contractor shall not begin installation until product sheets and pertinent information is submitted. Below are a list of items required, additional items may be necessary
      a. Lawn / Native Seed
      b. Sod (Highland and Grower)
      c. Fertilizer
      d. Mulch (Manufacture and Location)
      e. Erosion control Blanket

B. Supply name of native/commercial seed installer for site with a minimum of 5 years similar experience of size and scope of project. Provide 3 references and sites

C. Product Data:
   1. Submit certification tags from sod, and seed verifying type and purity to Owner.

D. Landscape Contractor Qualifications:
   1. Provide statement of required qualifications of Landscape contractor.
   2. Provide Owner a minimum of 5 project names, addresses, project owner's names and phone numbers for completed projects of similar size and scope.

E. Top Soil:
   1. Fertility tests or certifications based on the standard testing procedures of the University of Minnesota Soils Testing Laboratory, Soil Science Department.

1.5 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   1. Pesticide Applicator: State licensed, commercial.

B. Top Soil Analysis: For each un-amended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory
   1. The soil-testing laboratory shall oversee soil sampling.
   2. Report suitability of tested soil for turf growth.
      a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

C. Pre-Work Meeting: Convene a pre-work meeting minimum 30 days prior to commencing work on this Section. Review conditions of operations, procedures and coordination with related work.
1. Review planting schedule and maintenance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Perform work only during weather conditions favorable to landscape construction and to health and welfare of plants and turf. Owner shall determine suitability of such weather conditions.

1.8 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
1. Seeded Turf: 60 days from date of planting completion.
a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
2. Sodded Turf: 60 days from date of planting completion.

1.9 WARRANTY

A. Warranty: Installer agrees to repair or replace turf grasses and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Death and unsatisfactory growth.

B. Replace plantings during normal planting season.

C. Warranty Periods from Acceptance/Final Payment by Owner:
1. Turf Grass, Native Grass and Sod: 12 months from date of planting

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Comply with MnDOT Specification No. 3876 supplemented as follows:
   1. Provide fresh, clean, new crop lawn seed mixture.
   2. Furnish to Owner dealers guaranteed statement of composition of mixture and percentage of purity and germination of each variety.
   3. Seed Mixture: Provide seed of grass species and varieties, proportions by weight and minimum percentages of purity, germination, and maximum percentage of weed seed.
   4. Seed mixtures vary by region and season, comply with MnDOT and Local Soil Conservation Service Standards for providing seed for the climate in the specific area of application.
   5. Comply with all MnDOT Specifications when selecting seed and seed source.

B. Grass Seed Mix:
   1. Refer to the Plans for specific seed mixes and application locations.

2.2 SOD

A. Sod: Comply with MnDOT Specification No. 3878 supplemented as follows:
   1. Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
   2. Provide sod species suitable as lawn turf for the region, strongly rooted, weed, disease, and pest free and uniform in thickness.
   3. Furnish to Owner dealers guaranteed statement of composition of mixture and percentage of purity and germination of each variety of seed.
   4. Seed mixtures vary by region and season, comply with MnDOT and Local Soil Conservation Service Standards for providing seed for the climate in the specific area of application.
   5. Classification:
      a. Nursery grown in sandy mineral soils planted on cultivated agricultural land and grown specifically for sod purposes. Sod grown in clay or peat-type soils is not allowed.
      b. Regularly mowed and maintained sod from establishment to harvest with reasonable quality and uniformity.
   6. Thickness: Machine cut sod at a uniform soil thickness of 3/4-inch, plus or minus 1/4-inch, at time of cutting. Measurement for thickness shall exclude top growth and thatch.
   7. Moisture Content: Do not harvest or install sod when moisture content (excessively dry or wet) may adversely affect survival.
   8. Time Limitations: Harvest, deliver, and install sod within a maximum period of 24 hours, depending on heat and moisture content, unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall not be laid unless approved by Landscape Architect.
   9. Thatch: Sod to be relatively free of thatch, up to ½ -inch uncompressed allowable thatch.
   10. Weeds: Free of grassy and broad leaf weeds. If less than 5 plants are found per 100 square feet of area, sod will be considered free of weeds. Sod is not be acceptable if it contains common bermudagrass (wiregrass), quackgrass, johnsongrass, poison ivy,

nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, hemp, wild garlic, ground ivy, perennial sorrel, or bromegrass.

11. Diseases, Nematodes, and Insects: Sod to be free of diseases, nematodes, and soil-borne insects

B. Sod Type:
   1. Refer to the Plans for specific sod types and application locations.

2.3 TOP SOIL

A. Salvage site topsoil and stockpile on-site for re-spreading.

B. Apply top soil amendments as indicated on the Plans.

C. Top Soil Borrow:
   1. Comply with MnDOT Specification 3877 supplemented as follows:
      a. Provide top soil borrow to supplement on-site salvaged top soil.
      b. Type of topsoil borrow is indicated on the Plans

2.4 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
   2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.5 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; free of substances toxic to plantings.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

E. Manure: Well-rotted, un-leached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.6 FERTILIZERS

A. Fertilizer: Comply with MnDOT Specification 3881 supplemented as follows:
1. Refer to the Plans for type, analysis and application rate.
2. Deliver fertilizer, mixed as specified, in original unopened standard size bags showing weight, analysis and name of manufacturer. Containers to bear manufacturer's guaranteed statement of analysis or manufacturer's certificate of compliance covering analysis shall be furnished to Owner. Store fertilizer so it will be kept dry.
3. Composition: Nitrogen, phosphorous and potassium in amount needed to remedy deficiencies identified in the results of the existing topsoil and in-place topsoil test performed by the geotechnical engineering company.

B. Soil Testing;
1. Soil test may be required to determine if soil amendments need to be added and the fertilizer analysis
2. Sample either the top soil stockpiles or the in place top soil prior to turf application.
3. Have sample analyzed by the University of Minnesota lab or testing agency. On-site testing kits will not be acceptable.
4. Sample either the top soil stockpiles or the in place top soil prior to turf application.
5. A minimum of 1 sample per 5,000 sq. ft. / No less than 3 samples per site.

2.7 MULCHES

A. Seed and Erosion Control Mulch: Comply with MnDOT Specification 3882 supplemented as follows:
1. Refer to the Plans for type, application method and locations for mulching.

2.8 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 Comply with MnDOT Specification 2575 supplemented as follows:

3.2 PROTECTION

A. Before commencing work, trees and shrubs that are to be saved shall be protected from damage by placement of fencing flagged for visibility or some other suitable protective procedure approved by Owner.

B. Trucks or other equipment shall not be driven or parked within drip line of any tree unless tree overspreads paved area.

C. Use precautionary measures when performing work around trees, sidewalks, pavements, utilities, and other features either existing or previously installed.

D. Adjust depth of earthwork and topsoil when working immediately adjacent to aforementioned features in order to prevent disturbing tree roots, undermining sidewalks and pavements, and damage in general to other features either existing or previously installed.

3.3 TURF AREA PREPARATION

A. If project completion date prohibits in season planting, prepare for out of season seeding or sodding so that lawns shall be completed and ready for acceptance at time of project completion.

B. Verify Landscape Plan requirements with permitting Agency.
   1. Permit requirements will be identified Plans.
   2. Coordinate a pre-construction meeting with permitting Agency staff.

C. Newly Graded Subgrades for Seed and Sod:
   1. Do not place topsoil until subgrade has been approved.
   2. Before placing topsoil, rake subsoil surface clear of stones, debris, and roots. Disk, drag, harrow, or hand rake subgrade to depth of 6 inches and remove stones larger than 1 inch to provide bond for topsoil.
   3. Spread topsoil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Adjust depth of topsoil in areas adjacent to paved surfaces or curbs to allow for the placement of sod or seed.

D. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface as follows:
   1. Remove existing grass with sod cutter to produce a clean edge. Do not mix into surface soil.
   2. Disk, drag, or harrow surface soil to a depth of at least 6 inches.
   3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
   4. Legally dispose of waste material, including grass, vegetation, and turf.
   5. Adjust depth of topsoil in areas adjacent to paved surfaces or curbs to allow for the placement of sod or seed.

E. Incorporate soil amendments and commercial fertilizer into the top 6 inches of topsoil to achieve the specified topsoil requirements. Till soil to a homogenous mixture of fine texture.

F. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Slope to drain. Limit finish grading to areas that can be planted in the immediate future.

G. Grade areas to finish grades, filling as needed or removing surplus topsoil. Float areas to smooth, uniform grade as indicated on the Drawings. Lawn areas shall slope to drain.

H. Where no grades are shown, areas shall have a smooth and continual grade between existing or fixed controls, such as walks, curbs, catch basin, steps, or buildings. Roll, scarify, rake, and

level as necessary to obtain true, even lawn surfaces. Finish grades shall meet approval of Owner.

I. Sod and seed beds shall be firmed by rolling before seeding begins.

J. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

K. Before planting, obtain Owner's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PERMANENT SEEDING

A. Sowing method and rate are indicated on the Plans.

B. Do not broadcast or drop seed when wind velocity exceeds 15 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

C. Seed areas by sowing evenly with approved mechanical or hydraulically applied seeder.

D. Surface layer of soil for seeded areas shall be kept moist during germination period. Water seeded areas twice first week to minimum depth of 6 inches with fine spray and once per week thereafter as necessary to supplement natural rain to equivalent of 6 inches depth

E. In small applications broadcast and rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

3.5 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
   1. Lay sod across angle of slopes exceeding 1:3.
   2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. All finished sodding will be smooth and free of lumps and depressions.

D. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.6 MULCHING

A. Comply with MnDOT Specification 2575 supplemented as follows:
   1. Type of mulch and application is indicated on the Plans.

3.7 TURF MAINTENANCE

A. Comply with MnDOT Specification 2575 supplemented as follows:

B. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.

D. After grass growth has started, reseed or sod areas that fail to show uniform stand of grass in accordance with the Drawings and as specified herein. Continue Reseeding and sodding such areas repeatedly until areas are covered with satisfactory growth of grass. Perform removal and replacement or topsoil conditioning if required to facilitate establishment of grass.

E. Grassed areas damaged during process of work to be restored or repaired to condition satisfactory to the Owner. Fill, grade, re-fertilize, replant, or mulch as required restoring to contract requirements.

F. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

G. No-Fault Repair and Correction: No fault repair and correction work shall consist of work to correct faults or repair damage existing through no fault of the Contractor, but which is necessary for the operation of on-site utilities, equipment, landscape plants or materials damage, or other corrections necessary for the duration of the Extended Maintenance/Warranty Period specified above. No fault repair and correction shall not include work as otherwise defined within the scope of Extended Maintenance

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Owner:
   1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
   2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

END OF SECTION 32 9200

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DIVISION 33 – UTILITIES

33 3100 SANITARY UTILITY SEWERAGE PIPING
33 3211 Sanitary Sewer Lift Station

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SECTION 33 0526 - UTILITY IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic warning tape for placement above direct-buried utility.
   2. Trace wire for placement above direct-buried utility.

1.2 SUBMITTALS

A. Product Data: Manufacturer's catalog information for each product required.

B. Samples: Two each detectable and non-detectable warning tape and trace wire as requested by the Engineer.

C. Manufacturer's Certificate: Products meet or exceed specified requirements.

D. Qualifications Statement:
   1. Qualifications for manufacturer.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged valves and manholes.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section with three years' experience.

PART 2 - PRODUCTS

2.1 UTILITY MARKERS (OMIT)

2.2 MARKING FLAGS (OMIT)

2.3 NON-Detectable WARNING TAPE

A. Manufacturers:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that are made in America, may be incorporated into the Work include, but are not limited to, the following:
      a. Reef Industries, Terra Tape.
      b. Allen, Markline.

Description:

1. Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 thick, continuously inscribed with a description of the utility, buried 18" above the pipe; colored as follows:
   a. Red: Electric.
   b. Yellow: Gas, oil, steam, and dangerous materials.
   c. Orange: Telephone and other communications.
   d. Blue: Water systems.
   e. Green: Sewer systems.

2.4 Detectable Warning Tape:

A. Manufacturers:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that are made in America, may be incorporated into the Work include, but are not limited to, the following:
      a. Presco.
      b. Brady.
      c. Proline.

B. Description:
   1. Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
      a. Red: Electric.
      b. Yellow: Gas, oil, steam, and dangerous materials.
      c. Orange: Telephone and other communications.
      d. Blue: Water systems.
      e. Green: Sewer systems.

2.5 TRACE WIRE

A. Manufacturers:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products offering products that are made in America, may be incorporated into the Work include, but are not limited to, the following:
      a. Kris-Tech Wire Company.
      b. Copperhead Industries.

B. Description:
   1. Conform to the applicable requirements of ASTM B-1, ASTM B227, ASTM D1248, and Commercial Specification SD 117.
   2. Conductor for use in open cut trench: [Double conductor # 12 AWG Solid Copper Type tracer wire with high molecular weight polyethylene (HMWPE) or High Density Polyethylene (HDPE) jacket. Conductors shall be solid, 21% conductivity copper.
   3. Conductor for use with jacking and boring or auger boring: Double conductor # 10 AWG 49 Strand (7 groups of 7 strands) Stainless Steel tracer wire with high molecular weight polyethylene (HMWPE) jacket. Conductors shall be annealed Type 302 stainless steel.

Construction shall be of the aircraft cable flexible type, 49 strands (7X7), dry, and oil-free.

4. Jacket: Thickness; 30 mil. Rated for 30 volts. Color coded for utility line:
   a. Red: Electric.
   b. Yellow: Gas, oil, steam, and dangerous materials.
   c. Orange: Telephone and other communications.
   d. Blue: Water systems.
   e. Green: Sewer systems.

C. Access Boxes
   1. Copperhead Industries 14 inches long with 2-3/4 inches ID ABS shaft, cast iron pentagonal locking lid, encapsulated magnetic beacon, internal swivel tracer wire connection lug, and arched base to resist pull-out or others which meet the requirements of this Specification. Access box lids shall be color coded for utility line:
      a. Red: Electric.
      b. Yellow: Gas, oil, steam, and dangerous materials.
      c. Orange: Telephone and other communications.
      d. Blue: Water systems.
      e. Green: Sewer systems.

2.6 ANCILLARY MATERIALS

A. Electrical tape: liner-less rubber high-voltage splicing tape and vinyl electrical tape suitable for moist and wet environments.
   1. Manufacturers: Equipment from the following manufacturers and which meet these specifications will be accepted or approved equal.
      a. 3M Products, Scotch 130 C.
      b. 3M Products, Scotch 88.

B. Connectors (Three-Way Lug): Allows tap without cutting the main line. Wire Size: #14-10 solid copper and #12 steel core copper-clad tracer wire. Includes silicon sealant. Designed for direct burial.
   1. Manufacturers: Equipment from the following manufacturers and which meet these specifications will be accepted or approved equal.
      a. Copperhead Industries CH90120.

C. Connectors (Wire nuts): Joins up to 4 #12 wires. Wire Size: #22-8 solid copper and #12 steel core copper-clad tracer wire. Designed for direct burial.
   1. Manufacturers: Equipment from the following manufacturers and which meet these specifications will be accepted or approved equal.
      a. Copperhead Industries CH10666.

PART 3 - EXECUTION

3.1 INSTALLATION

A. According to manufacturer instructions.

B. Ribbon/Warning Tape:

1. Install warning tape directly above ferrous utility pipes, 12 inches below finished grade, except 6 inches below sub-grade under pavements and slabs. Install detectable warning tape over non-ferrous pipes

C. Tracer Wire

1. Tape tracer wire to the top of all non-metallic pipe every ten feet (approximately). Use caution during installation to prevent stretching wire and nicking or cutting wire insulation. In the case of a dual or multiple pipeline system, fasten tracer wire to each pipe.
2. Tracer wire shall be continuous between maintenance structures. Do not cut the wires at the access boxes.
3. Coil sufficient length of wire inside access box so that when straightened they would extend 18-inches above top of access box. Connect end of tracer wire to access box swivel wire connector.

D. Access Boxes:

1. Quantity: At each Utility Structure. In the case of a multiple pipeline system, Use one access box for each tracer wire.
2. Gravel base: Access box shall be surrounded by 6" of gravel on all sides to prevent weed growth and erosion.
3. Mount next to Utility Structure in an easily assessable location. Furnish "as-built" drawings with the locations of access boxes clearly indicated.
4. Provide junction box for tracer wire easy selection for continuity or an open circuit.

E. Connections to Metallic Pipe:

1. Bond tracer wire to metallic pipe at transitions to non-metallic pipe as specified below.
2. The electrical connection of copper wire or copper strap to metallic (steel, cast iron, and ductile iron) surfaces shall be by the thermite weld method.
3. Assure that pipe or fitting wall thickness is of sufficient thickness that the thermite weld process will not damage the pipe or fitting wall's integrity or damage the lining in any way.
4. All connections to stainless steel materials, copper, and light wall steel tubing (0.035-inch or less), shall be either with a silver soldered connection (silver brazing) or a physical type connection.
5. Connections to stainless steel fittings and appurtenances can be made with a ring tongue terminal placed under a bolt or a soldered connection. Cadweld connections to stainless steel are not allowed.
6. Connection to metallic or ferrous components of concrete cylinder pipe shall be with a cadweld or welded type connection.

F. Thermite Weld or Cadweld Method.

1. The CONTRACTOR is responsible for repair of any damage to pipe, fitting, lining, or coating as a result of the thermite weld process.
2. Make thermite weld connections at locations as directed by pipe manufacturer so as to not damage pipe gasket or internal linings exposed to liquid.
3. For heat-shrink sleeve coated pipe joints, the copper joint bond strap shall be installed and the connection cleaned prior to installation of the heat shrink joint coating. Copper strap bonds shall be formed to match profile of joints, so as to allow full encapsulation

with the heat shrink sleeve joint coating. Install filler wedge or filler tape parallel to copper strap and joint so as to provide a smooth transition for heat shrink sleeve.

4. For lined (epoxy, polyurethane, polyethylene, etc) pipe where damage may occur to lining from the thermite welding process make thermite connection on the shop welded stud or thermite weld plates provided on the pipe for this purpose. Clean the fitting surface, steel studs, or thermite tab plate to bright metal before thermite welding.
5. If approved by pipe or fitting manufacturer, for pipe bell and spigot joints and flanged fittings, connections to the pipe or fitting end may be made directly to the pipe or fitting on the non-pressured (dry) side of the pipe joint or fitting surface. On pipe and fittings when making connections to surface exposed to dry environment, taking care to not damage gaskets or sealing devices.
6. The electrical quality and resistance of the connection is dependent on proper adhesion of the welded connection to the pipe or fitting surface. Observe proper thermite weld material selection, safety precautions, surface preparation, and welding procedures as recommended by the material manufacturer.

G. Jacking and Boring or Auger Boring:

1. Install tracer wire concurrently with pipe. Tracer wire shall be taped to pipe every ten feet (approximately). Use caution during installation to prevent stretching wire and nicking or cutting wire insulation.

3.2 TESTING

A. Testing: Test each splice and all bonds to metallic pipe for continuity in accordance with the Digital Low Resistance Ohmmeter Method as specified below.

B. Digital Low Resistance Ohmmeter Method:

1. Furnish the following equipment and materials:
2. One digital low resistance ohmmeter (DLRO) Biddle 247000 Series. DLRO shall have Kelvin Bridge type measurement circuit, minimum 10 amperes of current, and micro-ohm resistance resolution to 0.1 micro-ohms with 0.25 percent accuracy. Biddle Series 247000 DLRO Meters, Model Numbers 247000, 247001, or 247002 and the Biddle Megger Ductor DLRO 10 or 10X.
3. One set of duplex test leads heavy duty fixed point current and potential handspikes, Biddle Model No. 242002-30, (Minimum 30 foot long cable length required). Four (4) foot cable lengths can be provided for individual joint bond resistance testing, but 30-foot cables must be provided for pipe span calibration testing. Leads are calibrated and shall not be spliced.
4. One calibration shunt rated at 0.001 ohms, 100 amperes.
5. Manufacturers: Equipment from the following manufacturers and which meet these specifications will be accepted or approved equal:
   a. Biddle Model No. 249004.
   b. MCM Miller 0.0001 ohms.
   c. 100 amperes Shunt.
   d. Megger International (formally AVO International), Dallas, TX manufactures Biddle Instruments (800-723-2861).
   e. DLRO instruments are available for rental from some corrosion material suppliers, local electric supply houses, and/or national equipment rental firms.

C. Test Procedure:

1. Measure the resistance of joint bonds with the low resistance ohmmeter in accordance with the manufacturer's written instructions.
2. Set meter on 10-amp range during test measurements.
3. Use the duplex handspikes to contact the pipe on each side of the joint, without touching the thermite weld or the bond.
4. The contact area shall be cleaned to bright metal by filing or grinding and without any surface rusting or oxidation.
5. Record the measured joint bond resistance on the test form described herein and attached.
6. Repair any damaged pipe coating.

END OF SECTION 33 0526

SECTION 33 1111 – PACKAGED METERING MANHOLE (PMM)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes
   1. Packaged Metering Manholes required for the complete installation of the work.

1.2 SYSTEM DESCRIPTION

A. Configuration
   1. Packaged Metering Manholes shall be watertight, corrosion resistant units consisting of (as a minimum): manhole barrel, top, confined space entry warning sign, coupling, flume with end adapters, end connections (pipe stubs / flanges / caulking collars), base, and mounting flange.
   2. Diameter
      a. 48-inches [1.22 m] I.D.
      b. Inside diameter tolerance: +/- 1%.
   3. Top style
      a. Domed fiberglass
      b. A full diameter, fully opening reinforced domed fiberglass cover with stainless steel hardware (hinge, padlockable hasp, and cover support gas strut), fiberglass hinge block, and a neoprene sealing gasket applied to the manhole barrel lip.
      c. The cover shall be designed and tested to withstand a minimum 1,000 lb. [453.6 kg] static load.
      d. For operator safety, the cover support gas strut shall be sized and mounted so that cover opens at any position unless locked.
   4. Height
      a. The manhole shall be for depth shown on plans.
   5. Domed fiberglass style:
      a. Surface grade plus 12-inches [30.48 cm].
   6. See plans for invert and exit eleveations.

B. Flume
   1. Single flume
   2. Size:
      a. 6-inch Parshall flume.
   3.

1.3 Related Sections

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

1.4 REFERENCES

A. Design, fabricate PMMs and materials in accordance with manufacturer's recommended procedures and the following codes and standards:

1.	ASTM A193	-	Stainless Steel Anchor Bolts
2.	ASTM D 256	-	Izod Impact Strength
3.	ASTM D 570	-	Water Absorption Rate
4.	ASTM D 638	-	Tensile Strength
5.	ASTM D695	-	Compressive Properties of Rigid Plastic
6.	ASTM D 696	-	Coefficient of Linear Expansion
7.	ASTM D 790	-	Flexural Properties
8.	ASTM D792	-	Density and Specific Gravity at 23^0 C
9.	ASTM D2563-0	-	Visual Defects
10.	ASTM D 2583	-	Indentation Hardness
11.	ASTM D2584	-	Resin, Glass & Filler Content
12.	ASTM D3753-12	-	Polyester Manholes
13.	ISO1438/1-1980	-	Open Channel Flow Measurement
14.	OSHA 1910.27	-	Fixed Ladders

B. Composition of the PMM laminate shall be in accordance with the recommendations shown in the Quality Assurance Report for Reinforced Thermoset Plastic (RTP) Corrosion Resistant Equipment prepared under the sponsorship of the Society of the Plastics Industry, Inc. (SPI), and the Material Technology Institute (MTI) of the Chemical Process Industry for "Hand Lay-Up Laminates," and shall meet the specifications for Type I, Grade 10 laminates shown in Appendix M-1 of said report.

C. Manufacturer shall be experienced in the design and manufacture of specific PMMs and accessories for a minimum period of 20 years.

D. Manufacturer must provide warranty for 25 years against failure due to corrosion.

1.5 SUBMITTALS

A. Product Data: Manufacturer information for materials of construction and fabrication.

B. Shop Drawings:

1. Detailed dimensions for materials and equipment, including wiring and control diagrams, performance charts and curves, installation and anchoring requirements, fasteners, and other details.
2. Manufacturer's specified displacement tolerances for vibration at operational speed specified for pumps.

C. Manufacturer's Certificate: Products meet or exceed specified requirements.

D. Manufacturer Instructions: Installation requirements, including storage and handling procedures, anchoring, and layout.

E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

H. Drawings
1. Project specific drawings, showing:
2. Overall structure length, width, and height.
3. Critical elevations.
4. Ladder, top, coupling, and primary device orientations.
5. Joints, connections, fasteners.
6. Sizes, spacing, and locations of structural members, ribs, anchoring clips, and dimensional bracing.
7. Materials and thicknesses of construction.
8. Minimum and maximum flow rates.
9. Generic layouts or check marked brochures shall be rejected without review.

I. Discharge Tables
1. Primary device level-to-flow discharge tables, showing:
2. Flow equations.
3. Submergence transition, where published.
4. Accuracy, where published.
5. Plan view layout showing critical dimensions and primary point of measurement (Ha).
6. Discharge table source.

J.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.7 DELIVERY, STORAGE AND HANDLING

A. Ship all PMMs with suitable packaging to protect products from damage.

B. Protect PMM flanges, tabs and accessories from damage.

C. The PMM shall be stored on a smooth flat surface, free of sharp objects, and if laid horizontally, shall be placed in such a way as to avoid structural damage.

PART 2 - PRODUCTS

2.1 PACKAGED METERING MANHOLE

A. Manufacturers:
   1. Plasti-Fab
   2. Openchannelflow
   3. Substitutions: Permitted.

2.2 MATERIALS

A. PMM body shall be:
   1. Engineered composite fiberglass reinforced plastic (FRP).
   2. Molded in one piece to create a seamless corrosion barrier impervious to moisture.
   3. FRP resin shall be vinyester.
   4. PMM Hardware (when applicable): stainless steel

2.3 DESIGN CRITERIA

A. PMM shall conform to ASTM D3753-12.

B. Composition of the PMM laminate shall be in accordance with the recommendations shown in the Quality Assurance Report for Reinforced Thermostat Plastic (RTP) Corrosion Resistant Equipment prepared under the sponsorship the Society of the Plastics Industry, Inc. (SPI) and the Material Technology Institute of the Chemical Process Industries, Inc. (MTI) for "Hand Lay-up Laminates" and shall meet the specifications for Type 1, Grade 10 laminates shown in Appendix M-1 of said report.
   1. Visual inspection for defects shall be made without the aid of magnification and defects shall be classified as to type and level as shown in Table 1 of ANSI/ASTM D2563-0, approved 1977, (or any subsequent revision). Allowable surface tolerances are as follows:

DEFECTS	ALLOWABLE TOLERANCE
Cracks Crazing Blisters Chips Pits Dry Spots Fish Eyes Burned Areas Entrapped Air	None
Wrinkles and solid blisters, not to exceed 1/8”	Maximum Deviation: 10% of thickness
Surface porosity (pinholes or pores in the laminate surface)	None
Exposed Glass Exposure of cut edges	None
Scratches	None more than .002” deep (.05mm)
Foreign Matter	None

2.4 CONSTRUCTION:

A. PMM

1. Each Packaged Metering Manhole shall be a complete integral unit consisting of: a corrosion resistant fiberglass reinforced plastic (FRP) manhole with sealed fiberglass bottom, fiberglass access ladder, metering flume and accessories as required.
2. PMM body shall be totally manufactured of fiberglass reinforced polyester.
3. Each PMM shall be molded individually to the exact dimensions specified.
4. The thickness of the walls and floor of the PMM shall be not less than 1/2" (12mm) thick.
5. PMMs shall be manufactured of reinforced thermoset plastic in one integral piece that is structurally strong, lightweight, watertight and corrosion resistant to salt water, ground water, corrosive soil conditions and many commonly encountered industrial chemicals.
6. PMM inside surface shall be smooth, isophthalic gelcoat of 10 - 20 mil (0.25 - 0.51mm) thickness. Exterior Surface shall be grey gel coat 15-20 mil (0.25 – 0.51mm) thickness for UV protection.
7. The surface shall be free of exposed reinforcing fibers.
8. The minimum glass content shall be 30% exclusive of gelcoat surfaces.
9. Any portion of the flume or end adapters extending outside the manhole shall have a reinforced cover.
10. The manhole sides, bottom and external flume sections shall be designed to withstand a static load of 150 lb/ft per foot (68 kg/305mm) of depth with less than l/4" (6mm) deflection.

11. There shall be no light duty angles of flanges protruding beyond the flume or manhole that can be damaged by shear or load forces.
12. Inlet and Outlet Pipes: The FRP manhole and flume shall be provided with 12 inch O.D. pipe stubs for connection to 12 inch / millimeter O.D. incoming and outgoing PVC pipe. Flume end adapters shall allow a smooth flow transition from pipe flow to flume flow.
    a. Two neoprene boots with stainless steel clamping bands shall be supplied and sized to connect inlet and outlet pipe stubs to the pipeline.
13. Cover
    a. The Packaged Metering Manhole will be furnished with a fiberglass cover equipped with heavy duty stainless steel hinges having l/2" (12mm) diameter hinge pins and stainless steel hasp for locking. The cover shall be sufficient strength to withstand a distributed 1000 lbs. (454kg) top load. The cover shall overlap the manhole and seat on a neoprene seal to prevent dirt, rain and debris from getting into the manhole.
14. Internal Ladder: The ladder rungs shall have a non-slip traction surface and internal stainless steel safety bar. The ladder shall meet or exceed OSHA General Industry Standards, Part 1910.27 for "Fixed Ladders".
15. Utility Tap: The manhole barrel shall be fitted with 2" (51mm) FRP through-wall utility tap(s) having threaded connections to permit sub-grade entrance for power, sample or recording lines without damaging the watertight integrity of the manhole.
16. A l/2” (12mm) thick expanded polystyrene bead board will be supplied for placement on the concrete slab under the manhole.
17. The manhole shall be equipped with hold down brackets for anchoring the unit to a concrete slab.
18. Options
    a. Instrument Shelf: Fiberglass shelf or bracket(s), as required,
    b. Flume / Whole Bottom Cover: Fiberglass grating shall be installed over the flume to provide a walking surface and to prevent debris from falling into the flume.
    c. Head deflector / lid warning sign / ladder up with safety track.
    d. Vent piping / explosion proof fan (wiring by others).

B. Flume
1. Integral flume shall be 6 inch flume
2. Flume shall comply with Flume Specification in this Section.
3. Nominal wall thickness shall be a minimum of l/4” (6mm) for areas inside the barrel and ½” (12mm) minimum for portions extending beyond the barrel.
4. Flume extending beyond the manhole shall have a reinforced watertight fiberglass cover of sufficient strength to withstand soil loads up to 150 lb/ft per foot (68 kg/305mm) of depth when buried.
5. Laminated, high visibility staffing gauge graduated in 1/10 ft and 1/100 ft.

C. FLUME ACCESSORIES
1. End Connections
2. End adapters
3. Inlet end adapter to transition the flow into the flume, with:
4. 12-inch [30.48 cm] schedule 40 PVC pipe stub.
5. Outlet end adapter to transition the flow out of the flume, with:
6. 12-inch [30.48 cm] schedule 40 PVC pipe stub

7. Mounting bracket for transducer

2.5 PHYICAL PROPERTIES

A. Structural characteristics for a 1/8" (3mm) glass mat laminate shall meet the following minimum physical properties:

Tensile strength	15,000 psi (1034 ksc)
Flexural Modulus	1,000,000 psi (70307 ksc)
Flexural Strength	20,000 psi (1406 ksc)
Compressive Strength	22,000 psi (1547 ksc)
Impact Strength	9.0 ft-lbs/in. (1.24 kgf/m)
Water absorption	0.13% (in 24 hours)

2.6 DIMMENSIONS

A. Fiberglass barrel shall be 4 FT diameter.

B. Manhole shall be (invert to grade) as shown on the plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PMMS TOO LARGE TO SHIP In One Piece WILL BE SHIPPED IN FLANGED AND MATCH-DRILLED SECTIONS ALONG WITH STAINLESS STEEL FASTENERS FOR ONSITE ASSEMBLY.

B. Verify that dimensions are correct and project conditions are suitable for installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Thoroughly clean and remove all shipping materials prior to setting.

D. Install products in accordance with engineer's specifications, local codes, general comments below and the Manufacturer's recommendations.

E. Care shall be taken in the handling, storage and placement of the PMM in preparation for installation. The contractor shall become familiar with the recommended handling and installation procedures used with fiberglass Metering Manholes to insure that the manhole is not damaged, and that the flume is installed in a manner that is consistent with obtaining good Open Channel flow results.

F. Slinging will be accomplished using nylon or other fabric material. Under no circumstances shall cable or chain slings be used in direct contact with fiberglass surfaces

G. The PMM shall be installed level end-to-end and side-to-side, and must remain level throughout installation. The flume is factory installed in the Metering Manhole so that it is absolutely level from front to back and from side to side, and must remain level after installation.

H. The site shall be excavated wide enough to accommodate the manhole and to provide a safe working environment for workers.

I. Concrete pad under metering manhole
   1. The contractor shall provide a level concrete slab with a smooth troweled surface. Pad elevation shall be as shown on the drawings, and positioned so that the invert of manhole piping matches that of the pipeline. Prior to manhole placement the slab shall be cleaned of all sharp objects and debris.
   2. The PPM manufacturer shall design the metering manhole base slab. The pad design shall be signed and sealed by a registered engineer in the state of Minnesota. Pour a pad of sufficient width and length to support all of the manhole, the flume, and the connecting piping. The thickness of the pad shall be a minimum of 8 inches thick and shall be sized to ensure that proper loading is observed, and that the manhole will not float. The surface of the pad should be troweled and level to one-eighth (1/8) inch. H. Clean the concrete slab of all sharp objects and debris before laying the foam pad provided with the manhole
   3. The foam pad supplied with the manhole shall be placed in the proper position.

J. If the pipe is already in place the neoprene boots and s/s bands shall be slipped onto the pipe ends before lowering manhole onto concrete slab. The neoprene boots can be slipped over pipe ends and the stainless steel clamps tightened securely. Under no circumstances shall petroleum lubricants of any type be used to install neoprene boots.

K. Packaged Metering Manhole shall be lowered onto pad in accordance with the manufacturer's written recommendations.

L. Flume level shall be checked and PMM adjusted if necessary.

M. After the level is confirmed all anchor bolts shall be securely tightened.

N. On larger flumes all open spaces under the flume shall be filled with grout to provide adequate structural support.

O. Backfill
   1. Care shall be taken to avoid uneven backfill loads on the FRP manhole and flume.
   2. Groundwater or surface water runoff shall not be allowed to accumulate in the open excavation around a manhole that has not been completely backfilled.
   3. Backfill materials shall be placed evenly around the packaged manhole in approximately 12” (305mm) lifts.
   4. If materials other than pea gravel or sand are to be used as fill there shall be no soil lumps or sharp objects such as rocks or concrete, or other debris larger than 1” (25mm) in size.

5. All fill work will be in compliance with local codes, and shall meet the inspection standards established by the engineer.
6. Stable Soils: Bearing capacity greater than 2000 lbs/ft2 (186 kg/m2). Native soil, 1/4" x 3/8" (6mm x 9.5mm) round aggregate gravel or sand shall be used as backfill material, and placed in accordance with the above specifications.
7. Unstable Soils and High Water Tables: Bearing capacity less than 2000/lbs/ft2 (186 kg/m2). Sand or 1/4" x 3/8" (6mm x 9.5mm) rounded aggregate, compacted, shall be used in unstable soils such as expansive clays, marsh and/or where the water table may be less than 5' (1524mm). from finished grade. Selected backfill shall be placed in maximum 12" (305mm) lifts, a minimum of 24" (610mm) surrounding the manhole, and compacted to 85% Standard Proctor Density.
8. Finish to Grade: For concentric top, contractor shall finish to grade using brick and mortar or precast concrete rings to construct chimney of required height. Mortar bed and first grade ring shall be firmly supported on flat, bearing shoulder of the packaged manhole.

3.2 ADJUSTMENT AND START UP

A. Check Flume for being level both directons and PMM for meeting dimensional requirements and cleaned per manufacture's instructions.

B. Start up / calibration of meter

C. Site to be left clean and free of any debris.

D. Representative shall complete a Certification of Proper Installation and provide copies to the Owner, Engineer, Contractor and Manufacturing Facility. (When applicable)

END OF SECTION 33 3111

SECTION 33 3100 - SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewerage piping.
2. Pipe markers.
3. Manholes.
4. Bedding and cover materials.
5. Adjustment of frame and ring castings to the final elevation.
6. Construction or reconstruction of precast sectional sanitary sewer manholes.

1.2 RELATED DOCUMENTS

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

B. All work shall be installed to be in compliance with all applicable State Plumbing and Building Codes in effect

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. DIP: Ductile Iron Pipe.

C. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

A. Product Data: Manufacturer information indicating pipe material to be used and pipe accessories.

B. Shop Drawings:

1. Structure locations and elevations.
2. Sizes and elevations of piping, conduit and penetrations
3. Casting frames and covers
4. Pipe Products and Fittings.

C. Manufacturer's Certificate: Products meet or exceed specified requirements.

D. Product and Qualification Data if required by Engineer:
1. Manufacturer Instructions: Special procedures required to install specified products.
2. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

3. Qualifications Statements:
   a. Qualifications for manufacturer, installer and licensed professional.
   b. Manufacturer's approval of installer

E. Manufacturer Instructions: Indicate special procedures required to install specified products.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record locations of pipe runs, connections, and manholes, cleanouts, rim and invert elevations.

1.6 QUALITY ASSURANCE

A. Perform Work according to the requirements of the State and Local Agencies having jurisdiction.

B. Perform Work according to the requirements of the State and Local Plumbing Codes.

C. Manufacturer: Company specializing in manufacturing products specified in this Section with 5 years' experience.

D. Installer: Company specializing in performing Work of this Section with 5 years' experience and approved by manufacturer

1.7 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.
   3. Prior to construction field verify existing inverts, pipe connection locations and building connection inverts and locations.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing, and moving precast manholes and drainage structures.

B. Storage:
   1. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
   2. Repair property damaged from materials storage.

C. Cold Weather Requirements: Comply with ACI 530/530.1.

D. Protection:
   1. Keep UV-sensitive materials out of direct sunlight.
   2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 SANITARY SEWERAGE PIPING

A. Cast-Iron Soil Pipe:
   1. Comply with ASTM A74.
   2. Type: Extra heavy or Service: Refer to the Plans.
   3. Inside Nominal Diameter: Refer to the Plans
   4. End Connections: Bell and spigot or Plain: Refer to Plans
   5. Fittings: Cast iron.
   6. Joints:
      a. Rubber gasket joint devices.
      b. Comply with ASTM C564.

B. Ductile-Iron Pipe and Ductile Iron Fittings
   1. ANSI/AWWA C151
   2. Class/Pressure Rating/Diameter: Refer to Plans.
   3. Push on joints: ANSI/AWWA C111.
   4. Restrained Joint: ANSI/AWWA C111.
   5. Joints: Pressure Rating; Same as pipe.
   6. Ductile Iron Pipe Fittings:
      a. Standard Fittings, ANSI/AWWA C110
      b. Compact Fittings. ANSI/AWWA C153
      c. Pressure Rating: 350 psi.
      d. Gasket Joints: Comply with AWWA C111.
   7. Polyethylene Encasement: AWWA C105, polyethylene casing.
   8. Standard Coatings:
      a. Cement Mortar Lining: ANSI/AWWA C104.
      b. Asphaltic Outside Coating.
   9. Special Coatings:
      a. Fusion Bonded epoxy interior and exterior coating: ANSI/AWWA C116.
   10. Rubber Gaskets, Lubricants, Glands, Bolts, and Nuts: Comply with AWWA C111.
   11. Polyethylene Encasement: AWWA C105, polyethylene casing.

C. Reinforced Concrete Pipe:
   1. Comply with ASTM C76 Class: Refer to Plans
   2. Reinforcement: Steel cage mesh
   3. Inside Nominal Diameter: Refer to Plans
   4. End Connections: Bell and spigot
   5. Fittings: Reinforced concrete.
   6. Joints: Refer to Plans for applications.
      a. Confined O-ring , ASTM C361
      b. ASTM C443.
   7. Refer to Plans for pipe class

D. Plastic Pipe:
   1. Material: PVC.
   2. Comply with ASTM D 3034, SDR 35 or SDR 26, Refer to Plans
   3. Inside Nominal Diameter: Refer to Plans.

4. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint, ASTM D 3212
5. Fittings: PVC.
6. Joints:
    a. Elastomeric gaskets.
    b. Comply with ASTM F477.

E. Plastic Pipe:
1. Material: Schedule 40 and 80.
2. Comply with ASTM D1785.
3. Inside Nominal Diameter: Refer to Plans
4. End Connections: Bell and spigot style, with solvent-sealed ends.
5. Fittings:
    a. Material: PVC.
    b. Comply with ASTM D2466.
6. Joints:
    a. Solvent welded with solvent cement conforming to ASTM D2564.
    b. Comply with ASTM D2855.

A. Polyethylene Pipe (HDPE):
1. Pipe: Comply with AWWA C901, AWWA C906, and ASTM D3035.
2. Pipe and fitting material PE 3408 or PE 4710
3. Pipe sizes shall conform to ASTM F714,
4. Fittings:
    a. Comply with AWWA C901 or AWWA C906.
5. DIPS (Ductile iron pipe size) system.
6. Dimension Ratio (DR) as shown on the drawings
7. Joints and Gaskets:
    a. HDPE to HDPE
        1) Thermo-butt fusion in accordance with ASTM D3261 and ANSI/AWWA C906, except where connecting to unions, valves, and equipment with threaded connections that may require future disassembly.
        2) Pipe lengths, fittings, and flanged connections to be joined by thermal butt-fusion shall be of same type, grade, and class of polyethylene compound and supplied from same raw material supplier.
        3) Follow manufacturer's recommendations for cold weather thermal butt fusion, if required by environmental conditions.
    b. HDPE to DIP and PVC
        1) PE 3408 or PE 4710 molded PE MJ Adapter.
        2) Follow manufacture's and AWWA Manual M55 recommendations for joining methods.

2.2 NON-PRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Ring-Type, Flexible Couplings:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Fernco Inc.
      b. Logan Clay Pipe.
      c. Mission Rubber Company; a division of MCP Industries, Inc.
   2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
   3. Center-Sleeve Material: Stainless steel.
   4. Gasket Material: Natural or synthetic rubber.
   5. Metal Component Finish: Corrosion-resistant coating or material.

2.3 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. EBAA Iron, Inc.
      b. Romac Industries, Inc.
      c. US Pipe.

2.4 Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

2.1 MANHOLES

A. Standard Pre-Cast Concrete Manholes
   1. Description: ASTM C 478, pre-cast, reinforced concrete, of depth indicated, with provision for sealant joints.
   2. Diameter: 48 inches minimum unless otherwise indicated.
   3. Ballast: Increase thickness of pre-cast concrete sections or add concrete to base section, as required to prevent flotation.
   4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor. On new installation use base sections with pre-fabricated benches and channels. Refer to Plans to verify applications.
   5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
   6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.

7. Joint Sealant: ASTM C 990), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches. Neenah R1981J or Badger F-15.
10. Adjusting Rings: As indicated on plan detail with height as required to adjust manhole frame and cover to the indicated elevation and slope
11. Grade Rings: Not Used.
12. Refer to Plan Details.

B. MANHOLE FRAMES AND COVERS:
1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch minimum-width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

C. MANHOLE-COVER INSERTS:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. FRW Industries; a Syneco Systems, Inc. company.
   b. Knutson Enterprises.
   c. L. F. Manufacturing, Inc.
   d. Parson Environmental Products, Inc.
2. Description; Manufactured plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gas-tight sealing.
3. Type: Solid.
4. Refer to Plans for applications.

2.2 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
    a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.

2.3 CONCRETE GROUT

A. Provide a commercial Grout, Cellular Concrete that conforms to the following requirements:
1. Cement, ASTM C150, Type I,II
2. Density, ASTM C495(no oven drying), 50 pef min
3. Compressive Strength, ASTM C495, 300 psi@28 day min, 100psi in 24 hours
4. Shrinkage ASTM , 1% by volume
5. Flow, ASTM, 35 sec max

2.4 ACCESSORIES

A. Pipe Markers: As specified in Section 33 0526, UTILITY IDENTIFICATION.

2.1 MATERIALS

A. Bedding and Cover:
1. Bedding: Refer to Plans and Plan Bedding Details
2. Cover: Refer to Plans and Plan Bedding Details Soil Backfill from Above Pipe to Finish Grade:
    A. Soil Type Refer to Plans and Plan Bedding Details and Section 31 0513, SOILS FOR EARTHWORK
    b. Subsoil with no rocks over 1 inches in diameter, frozen earth, or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to Section 31 2316.13, TRENCHING for trenching, backfilling and compaction,

B. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

3.2 PREPARATION

A. Correct over-excavation with fine aggregate, coarse aggregate or lean concrete as directed by the Engineer.

B. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

C. Protect and support existing sewer lines, utilities, and appurtenances.

D. Utilities:
   1. Maintain profiles of utilities.
   2. Coordinate with other utilities to eliminate interference.
   3. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION:

A. Excavation and Bedding:
   1. Excavate pipe trench as specified in Section 31 2316.13, TRENCHING.
   2. Place bedding material at trench bottom.
   3. Level materials in continuous layer not exceeding 6 inches compacted depth.
   4. Compact to 95 percent of maximum density.
   5. Backfill around sides and to top of pipe with cover fill, tamp in place, and compact to 95 percent of maximum density.
   6. Maintain optimum moisture content of bedding material to attain required compaction density.
   7. Hand trim excavation for accurate placement of piping to indicated elevations.
   8. Dewater excavations to maintain dry conditions to preserve final grades at bottom of excavation.
   9. Place geotextile fabric as indicated on the Plans.

B. Piping:
   1. Install PVC pipe, fittings, and accessories according to ASTM D2321 and seal joints watertight.
   2. Install ductile-iron, gravity sewer piping according to ASTM A 746.
   3. Lay pipe to slope gradients as indicated on the Plans.
   4. Maximum Variation from Indicated Slope: 0 to One-half (1/2) inch, refer to Plans for applications.
   5. Install bedding at sides and over top of pipe, to minimum compacted thickness shown on the Plan Bedding Details
   6. Backfill and compact as shown on the Plans and specified in Section 31 2316.13, Trenching.
   7. Do not displace or damage pipe when compacting.
   8. Make the connections to facility sanitary sewer piping and site sanitary sewer piping at the locations shown on the Plans.
   9. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected as shown on the Plans.

10. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.
11. Pipe Markers:
    a. Install plastic warning tape continuous 18 inched above PVC and ductile iron pipe.
    b. Install tracer wire over non-ferrous material pipe continuous on top of pipe.
    c. Coordinate with trench Work as specified in Section 33 0526, UTILITY IDENTIFICATION.

3.4 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure, drainage piping according to the following:
    1. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on and mechanical joints.
    2. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
    3. Join dissimilar pipe materials with non-pressure-type, flexible or rigid couplings.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
    1. Use non-pressure flexible couplings where required to join gravity-flow, non-pressure sewer piping un-less otherwise indicated.
        a. Rigid couplings for pipes of same or slightly different OD.
        b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
        c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.5 MANHOLES:

A. General: Install manholes complete with appurtenances and accessories as shown on the Plans.
    1. Excavate for manholes as specified in Section 31 2316, EXCAVATION and SECTION 31 2316.13, TRENCHING
    2. Install pre-cast concrete manhole sections with sealants according to ASTM C 891.
    3. Form continuous concrete channels and benches between inlets and outlet if not pre-cast into the base section.
    4. Establish elevations and pipe inverts for inlets and outlets as indicated on the Plans.
    5. Mount lid and frame level in grout, secured to top cone section to indicated elevation.
    6. Set tops of frames and covers ½ inch below finished surface of manholes that occur in pavements.
    7. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.6 CONNECTIONS

A. Pipe connections to existing manholes by core drilling the pipe opening and installing a flexible pipe boot.

B. Connect non-pressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.7 MANHOLE RECONSTRUCTION AND CASTING FRAME ADJUSTMENT

A. Saw cut existing paving.

B. Clean manholes.

C. Adjust manhole frames and lids
   1. Remove existing manhole frames and covers.
   2. Install or remove pre-cast manhole sections as required.
   3. Use flat or tapered rubber manhole rings or rings shown on the Plans to achieve indicated elevation for frame and cover.
   4. Use sealant to seal joints between manhole top, rubber rings, and frame.
   5. Mount lid and frame level in grout, secured to top cone section to indicated elevation.
   6. Reinstall removed manhole frame and cover
   7. Set tops of frames and covers ½ inch below finished surface of manholes that occur in pavements.
   8. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

A. Replacing Manhole Frames and Covers:
   1. Remove existing manhole frames and covers to enable reuse.
   2. Deliver removed manhole frames and covers to Owner as maintenance materials
   3. Install new frames and covers for manholes as indicated.
   4. Adjust new frames and covers to match finished grade as indicated.
   5. Seal joints between manholes and manhole frames.

A. Paving Restoration:
   1. Restore bituminous paving areas as specified in Section 32 1216, Asphalt Paving

A. Landscaping Restoration:
   1. Restore grassed areas as specified in Section 32 9200 – Turf Seed and Sod.

3.8 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
   1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
   2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

3.9 FIELD QUALITY CONTROL

A. Request inspection by Engineer prior to and immediately after placing bedding.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect, repair and repeat procedure until results are satisfactory.

C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects. Verify testing requirements, inspections and reports with the agency having jurisdiction for approval of building permit and occupancy certificate.
1. Do not enclose, cover, or put into service before inspection and approval.

D. Testing:
1. Perform testing on Site sanitary sewage system according to the State and Local Agency requirements.
2. Pipe Testing: When allowed preform testing as follows:
a. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
b. Hydrostatic Tests: (OMIT)
c. PVC Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
1) Option: Test plastic gravity sewer piping according to ASTM F 1417.
2) Option: Test concrete gravity sewer piping according to ASTM C 924.
3. Mandrel Test: Conduct after pipe and trench has been backfilled for 30 days. The mandrel shall have a minimum diameter of 95% of the interior diameter of the sanitary sewer pipe
4. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
5. Bedding and Trench Backfill Compaction Testing:
a. Comply with Section 31 2316, Excavation and Section 31 2316.13, Trenching.

3.10 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.11 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 33 3100

SECTION 33 3211 - SANITARY SEWER LIFT STATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This work shall consist of furnishing all labor, materials, tools and equipment necessary to complete the Lift Station Improvements and appurtenant work as shown on the plan sheets and specified herein.

B. Work at the Lift Station shall consist of constructing a new wet well, new valve vault, debris basket, installing two (2) submersible pumps in the new wet well, furnishing and installing piping, fittings and valves in the wet well, and furnishing and installing discharge piping, fittings and valves from the wet well structure to the force main. The Contractor will be responsible for furnishing and installing discharge connection elbows, guide rail system, valves, piping, concrete slab, and all necessary work for construction of the pumping system. The completed lift station shall be operable at design flow and head conditions.

C. Construction of the lift station's wet well, valve vaults, discharge and force main piping, and influent piping may require dewatering. Dewatering is considered incidental to the work.

1.02 SUBMITTALS

A. Shop drawings shall be submitted for approval by Engineer in accordance with Division 1. Submit the following as a minimum for review:

1. Detailed specifications, dimensions, and weights of pumps, hatches, valves, piping, structures, manholes, and other appurtenances.
2. Typical installation guide.
3. Access hatch drawings.
4. Technical manuals.
5. Parts list.
6. Operation and Maintenance data.

1.03 RELATED SECTIONS

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

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE STRUCTURES

A. The wetwell and valve vault structures shall be constructed of Class I precast reinforced concrete with R4 joints and having an inside diameter as shown on the plans. The valve

vault structure shall be constructed as shown on the detail drawings and in accordance with the approved shop drawings. The concrete mix shall be Type I or II cement with C3A content less than 8 percent (Sulfate resistant) with entrained air content of not less than 4 percent and not more than 7 percent, Grade A concrete with a cement water ratio of 0.50 and a minimum compressive strength of 4,000 psi and 28 days. Precast structure shall have attained the specified design strength when delivered to the project site.

B. The top slab of the structures shall be Type II precast reinforced concrete having the dimensions shown on the detail drawings. Frames for access hatches and vent pipe shall be cast in the slab when fabricated. Cut-outs to accommodate all piping entering the wetwell shall be performed or pre-cut and provided with a seal or water stop to ensure a watertight connection between pipe and wetwell. The type of seal proposed shall be submitted to the Project Engineer for approval before installation of the wetwell is undertaken. Top slabs shall be designed for a minimum H-20-wheel loading.

C. Joints between barrel riser sections and top slab shall be sealed with two strips of flexible bitumastic preformed joint compound

D. The interior of the existing lift station and valve vault shall be painted as specified in Section 09960.

2.02 PUMPS

A. Pumps

1. Two (2) pumps shall be installed by Contractor for the Lift Station. The pumps shall be rated for a maximum of 20 HP, 208V, three phase, 60 hz, at 1740 rpm. The motors shall be non-overloading at any point on the pump curve. The pumping units shall be rated for continuous duty. Pumps shall operate at the following conditions:

a. Performance and Design Criteria:

(a) Number of Pumps: 2

(b) Speed Control: VFD

(c) Primary Operating Conditions

(i) Design Flow Rate: 800 gpm.

(ii) Also be able to pump Design Flow Rate: 500 gpm

(iii) Design Flow Total Dynamic Head: 52 feet.

(iv) Minimum Efficiency at Design Flow Rate: 72 percent.

(d) Maximum Motor Speed: 1750 rpm

(e) Shutoff Head (minimum): 75 feet

(f) Service Liquid: Raw Wastewater.

(g) Pump Motor horsepower 20 hp

(h) Power requirements: 208 VAC, 3-Phase, 60 HZ

(i) Capable of handling municipal solids with concentration of 1.5 percent.

(j) Impeller: dual vane

(k) Discharge Flange Outlet Diameter: 6 inch

2. Basis of Design: Flygt Pump Model: NP 3153 ~ 434MT
   (a) Access Hatch: See plan, coordinate with pump manufacturer.

B. Pump Manufactures
1. Flygt Pump Model: NP 3153 ~ 434MT
2. Hydromatic
3. KSB
4. ABS
5. Barnes
6. Substitutions: Permitted

C. Pump Design
1. Pumps shall be centrifugal, non-clog, solids handling, submersible, explosion proof wastewater type pumps capable of handling raw unscreened wastewater and passing a three-inch diameter solid sphere. The pump casing shall have a centerline discharge equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment. The pumps shall automatically connect to the discharge piping when lowered into position. The pumps shall be easily removable by one (1) operator with a portable hoist for inspection or service, requiring no bolts, nuts, or other fasteners to be removed for this purpose, and no need for personnel to enter the wet well.
2. The pump volute, motor, and seal housing shall be high quality grey cast iron, ASTM A-48, Class 35B. Volute shall have integral spiral shaped cast grooves at the suction. All external mating surfaces shall be machined, and Buna-N Rubber o-ring sealed. All fasteners exposed to the pumped liquids shall be 316 stainless steel.
3. The pump lifting handle shall be stainless steel, type 304 or 316.
4. The pump impellers shall be multi-vane, backswept, semi-open, non-clogging design and the impeller shall be dynamically balanced. The impeller shall be A-48 Class 35 B Cast Iron.
5. A wear ring system shall be installed to provide efficient sealing between the volute and impeller. Replaceable metal wear rings shall have a Brinell hardness of 200 or more.
6. The pump shaft shall be AISI Type 431 stainless steel. Pump shaft shall be extension of motor shaft.
7. The pump bearings shall have a B10 bearing life of a minimum of 50,000 hours. Pump shaft shall rotate on two (2) bearings.
8. The pump shall be provided with an oil chamber for the shaft sealing system. The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside.
9. The pump shall have an electrode probe mounted in the seal chamber. The probe shall be connected via a submersible cable to the control panel to alarm a seal failure when liquid is sensed, including a light in the control panel to notify the operator of a problem.
10. The pump shall have two (2) mechanical seals mounted in tandem. Each seal shall be held in contact with its own spring. The upper of the tandem set of seals shall operate in an oil chamber located just below the stator housing. This set shall contain one (1) tungsten carbide ring and one (1) carbon ring that function

as an independent secondary barrier between the pumped liquid and the stator housing. The lower of the tandem set of seals shall function as the primary barrier between the pumped liquid and the stator housing. This set shall consist of two (2) rings, both of which will be tungsten carbide.

11. Protect all metal surfaces in contact with pumpage, other than stainless steel or brass, with a factory applied spray coating of exterior epoxy paint.

D. Pump Motors

1. The motors shall be submersible type that has been tested and approved by Factory Mutual and U.L. as explosion proof suitable for use in a Class I, Division I, and Group D explosion proof area. The motor stator rotor, and bearings shall be mounted in a sealed submersible housing. The stator windings shall have Class F or better insulation. Motors shall be equipped with thermal overload protection capable of resetting automatically after cool-down.
2. The pump and motor shall be designed so that they may operate partially or totally submerged in the water. The pump and motor shall be rated for continuous duty.
3. The motor stator shall be held in place by a removable end ring that may be easily removed in the field without the use of heat or a press. The electrical power cord shall be terminated in a terminal box, which is sealed on the top and bottom to allow disconnection of the power leads without allowing moisture entry into the motor casing.
4. The power cable shall be sized according to NEC and ICEA standards and shall be of sufficient length to reach the terminal strips inside the control panel without any need for splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without the loss of watertight integrity to a depth of sixty five feet (65').
5. Motors shall be sized so they are not loaded above full-load rating at any point on the impeller operating curve. Operation in the motor "service factor" range is not acceptable.
6. Minimum motor efficiency shall be 0.84.
7. Motors shall be suitable for 208 VAC, three-phase, 60 HZ operating power.
   Motor Protection
   a. The motor shall be protected from thermal damage by a group of three separate thermostatic switches embedded into the stator windings, one per stator phase.
   b. Each switch shall open independently and terminate VFD and motor operation if temperature of the protected winding reaches the high temperature set point of 90% of insulation temperature rating and shall automatically reset upon cooling of the winding.
   c. The thermal sensing device shall be connected to the pump control panel by the CONTRACTOR.
   d. The pump shall utilize a single probe to monitor both the motor and seal chambers for moisture intrusion. The detection of moisture in either chamber shall send a signal to the control panel which shall be used to notify the user of the need for an inspection

8. Motor
   a. The motors shall meet NEMA premium efficiency (3” discharge pumps, as identified below, will only require standard efficiency) in accordance with IEC 60034-30, level IE3 and NEMA MG1 [NEMA 12.60 Enclosed motor].
   b. Motor rating tests shall be conducted in accordance with CSA C390-10 requirements and shall be certified accurate and correct by a third party certifying agency.
   c. A certificate shall be available upon request.

2.03 PUMP GUIDE RAILS, CABLE HOLDER, LIFTING CHAIN

A. Lift stations shall be equipped with dual stainless steel guide rails to guide the pump into proper alignment with the discharge elbow. The guide rails shall extend from the discharge elbow to the upper guide holder on the access door. Guide rails shall be full length, single piece construction from the factory. Field welded guide rails shall not be acceptable. All guide rail piping and bracing inside the wet well structures shall be stainless steel. The guide rail diameter and guide rail bracing spacing shall be as recommended by the pump manufacturer. Intermediate guide rail braces shall be stainless steel.

B. A 316 stainless steel cable holder shall be provided to hold the cables.

C. The pumps shall be equipped with a 316 stainless steel lifting chain long enough and strong enough to raise the pump for removal and inspection.

D. All piping and bracing inside the wet well structure shall be stainless steel with the exception of the discharge pipe, discharge elbow and drain line. Provide intermediate stainless steel support at intervals not to exceed 10 feet (10')

E. Provide non-corrosive cable racks.

2.04 ACCESS HATCH

A. Access Hatch
   1. Pump manufacturer to verify hatch size and location in top slab for clearance of pumps positioned as shown on the Drawings. Minimum clearance of three inches (3") required. Access hatch in the wet well shall be provided with safety grating.
   2. Door leaves a minimum 1/4-inch aluminum, diamond pattern, to withstand a live load of AASHTO H20 per the Standard Specifications for Highway Bridges is theoretical hand calculations. with other safety factors vs actual proof load testing for AASHTO M306 Standard Specification for Drainage, Sewer, Utility, and Related Castings.
   3. Channel frame to be minimum three-inch (3") welded aluminum with anchor flange around the perimeter.
   4. Each door leaf equipped with heavy duty recessed hinges, totally enclosed spring or torsion bar operators as necessary for easy operation, drop handle, and

automatic hold open arm with release handle. Locate hold open arm release handle such that it can be easily operated without endangering personnel.

5. Maximum hatch opening force is not to exceed fifteen (15) pounds when applied perpendicularly to the hatch edge through any part of the hatch-operating arc.
6. Each door leaf secured with snap lock with removable handle and padlock hasp welded to each leaf and frame.
7. Aluminum surfaces mill finished. Apply bituminous paint to the exterior of the frame in contact with concrete.
8. Mechanical Fasteners and Hardware: Series 304 stainless steel.
9. Approved Manufacturers: Halliday, Bilco, Nystrom, or equal.

B. Safety Grating

1. The protective safety grating panel shall be supplied as part of each hatch and shall be one and one half inch (1-1/2") "I" bar aluminum grating with Safety Orange powder-coated finish. Grating shall be hinged, and shall be supplied with a positive latch to maintain unit in an upright position. Grating shall have a six inch (6") viewing area on each lateral unhinged side for visual observation and limited maintenance. Grating support ledges on 300 lbs. psf loaded access covers only shall incorporate nut rail with a minimum of four (4) stainless steel spring nuts. A padlock hasp for owner-supplied padlock shall be provided. Saftey Grating shall be split to allow removal of one pump, while the other half is still in place.
2. Approved Manufacturers: Halliday, Bilco, Nystrom, or equal.

2.05 PIPING AND VALVES

A. Ductile Iron Pipe (DIP)

1. Ductile iron pipe shall conform to the requirements of ANSI A221.51 (AWWA C151) standard specification for centrifugally cast ductile iron pipe for water or other liquids.
2. Ductile iron pipe in exterior locations shall be provided with flanged, or mechanical joint type ends as shown on the plans and all interior ductile iron piping shall be ANSI/AWWA thickness Class 53 (minimum).
3. Ductile iron flanges shall conform to ANSI/AWWA C115 standard 125# template and shall be rated for 250 psi. Mechanical joints and push-on joints shall conform to ANSI/AWWA C111 standard for rubber gasket joints for ductile iron and gray iron pressure pipe and fittings.
4. Unless otherwise shown on the plans, ANSI/AWWA short-body ductile iron fittings shall be furnished. Short body fittings shall conform to ANSI/AWWA C110. Flanged long radius elbows, reducing on-the-run tees, side outlet fittings eccentric reducers and laterals shall conform to ANSI B16.1 standard specification for flanged fittings and flanges. All fittings shall be ductile iron. Compact fittings conforming to ANSI/AWWA C15/A21-53 may be supplied for mechanical and push-on joints.
5. Ductile iron pipe and fittings shall be furnished with standard bituminous interior coating. Pipe used for interior and exposed location shall not have a bituminous

exterior coating but shall be furnished with a shop primed coating of Tnemec Primer, or equal, to facilitate painting as specified.

B. Swing Flex Check Valves

1. Check valves shall be of the swing-flex, full body flanged type, with domed access cover and only one moving part, the valve disc. Valves shall be capable of submerged service. All valves shall be of the same manufacture. Check valves to have a pressure rating of 150 psi minimum at 150° F.
2. Valve body shall be cast iron ASTM A126, Class B. 100% pipe flow area, with no restrictions at any point through the valve. Seating surface at a 45° angle to minimize disc travel. Full size access port, allowing removal of the disc without removing the valve from the pipeline.
3. The valve cover shall be cast iron ASTM A126, Class B, domed in shape, to allow the disc to fully open should waste solids collect behind the disc.
4. The cover gasket shall be Lexide NK-511, and the cover bolts shall be stainless steel.
5. The disc shall be Buna-N (NBR), ASTM D2000-BG, one piece construction, compressed molded with an O-ring type sealing surface, containing steel and nylon reinforcements in both the pivot and central disc area. The disc shall be provided with non-slam closing characteristic through a short 35° disc stroke and a memory flex disc return action.
6. Backflow capabilities shall be provided by means of an optional screw type backflow actuator. Actuator shall be field installable without modification to the valve or a need for special tools.
7. Coating shall be ANSI/AWWA C550 epoxy coating, inside of body and cover. Manufacturer's standard exterior primer and finish coat shall be provided.
8. Check valves shall be as manufactured by Valmatic (Series 500) or APCO (Series 100).

C. Plug Valves

1. Non-lubricated, eccentric-type, plug-design, 1/4-turn of plug to fully open and close valve. Full-open port area through valve not less than 80% pipe cross-sectional area. Drip-tight shutoff in both directions at full-rated pressure.
2. Use fanged or screwed connections (as necessary to match piping) for valves.
3. Valve bearings, stem seals, plug seats and bodies:
4. AWWA C507 and ASTM A126.
5. Class B.
6. Semi-steel valve body.
7. Raised, 90% nickel plug seat for valves 3" and larger.
8. Adjustable Buna-N packing.
9. Neoprene faced plug.
10. Stainless steel bearings.
11. Provide minimum 6" diameter handwheels for manually operated valves.
12. Provide bolted, removable bonnets. Use geared actuators for valves 8" and larger; heavy duty, corrosion resistant, totally enclosed and sealed gear-box

construction. Minimum design cold water working pressure: 175 psi per ANSI B16.1.

13. Pressure test all valves 4" and larger in shop. Minimum 300-psi hydrostatic water test pressure. Reject defective valves. Manufacturer to provide certified test results stating that valves furnished did not leak under test conditions

2.06 WALL SLEEVES AND WALL SEALS

A. Wall sleeves shall be heavy wall stainless steel pipe with continuous welded waterstop. Anchor waterstop collar shall have outside diameter four inches (4") greater than the outside diameter of wall sleeve.

B. Wall seal shall be Link Seal as manufactured by Thunderline Corp.; or equal.

2.07 PIPE SUPPORTS

A. Steel Pipe Supports

1. Pipe supports shall conform to the requirements of MSS SP-58, MSS SP-69 and MSS SP-89. Where pipe supports contact bare piping or in-line devices, provide supports of compatible material so that neither shall have a deteriorating action on the other.
2. Pre-engineered support systems constructed of electrogalvanized steel products factory fabricated by firms regularly engaged in the manufacture of these items shall be used for this work.
3. Adjust support size and style to account for pipe insulation.
4. Where needed, use stainless steel epoxy adhesive anchor bolts, Hilti 150 injection adhesive anchors or equal, for building attachments.
5. All meters, valves, equipment, and other point loads shall be independently supported to prevent undue pipe stress and failure. The piping shall support no meter, valve, or other equipment.
6. All anchor bolts installed as part of a pipe support system, regardless of location or application, shall be manufactured of Type 316 Stainless Steel.
7. All hanger rods, bolts, u-bolts, turn buckles, aircraft cable, nuts, and washers shall be Type 316 stainless steel.
8. Unless otherwise indicated on the drawings, piping shall be supported at one and one half inch (1-1/2") out from the face of walls and at least three inches (3") below ceilings.
9. Unless specified to be fabricated of stainless steel, all fabricated pipe supports shall be blasted to a white clean condition after fabrication and hot-dip galvanized in accordance with ASTM 123.

2.08 ANCHOR BOLTS AND HARDWARE

A. The Contractor shall furnish all necessary anchor bolts, washers, hex nuts, and gaskets as well as templates required for setting anchors. Anchor bolts, washers, and hex nuts shall be 316 stainless steel.

2.09 FOUNDATION MATERIALS

A. Granular materials furnished for use in foundation, bedding, encasement, or backfill construction shall conform to the following requirements:
   1. Foundation material shall meet the requirements of MnDOT 3149.2H Coarse Filter Aggregate.
   2. Backfill material shall meet the requirements of MnDOT 3149.2B2 Aggregate Backfill

2.10 TEMPORARY SERVICE

A. Furnish, install and maintain equipment as necessary to bypass and control the sanitary sewer flow around the construction zone.
B. Provide temporary bypass piping between the temporary pump in the upstream manhole and the proposed valve vault connection for the bypass piping. The bypass piping shall be minimum six inch (6") diameter piping.
C. Provide all necessary traffic controls and security devices to maintain temporary pumping system. Failure to operate and maintain the bypass equipment could result in direct damage claims as well as consequential damage claims to the CONTRACTOR.

2.11 DEBRIS BASKETS

A. The B1B series trash basket system, as manufactured by Halliday Products, Inc. of Orlando, Florida or equal.
B. Bar screen style basket, having 2" (51mm) clear opening between 1/4" (7mm) thick bars and solid sides.
C. The heavy duty ladder/guide rail system shall be of 3" (77mm) structural aluminum channel and incorporate 1 3/8" (35mm) diameter type "D" rungs with flat resistant surface, spaced 12" (305mm) O.C..
D. For ease of operation, the basket will have (4) 2 1/2" (64mm) solid aluminum wheels with 1/2" (13mm) stainless steel axles.
E. An aluminum basket stop shall be supplied loose for field mounting to insure proper basket position.

2.12 CONTROLS

A. See DIV 26 and 40 specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with the manufacturer's recommendations and as shown on drawings. Coordinate access hatch and vent pipe locations and installation with wet well and valve vault precast concrete cover supplier.

3.02 WET WELL STRUCTURE

A. Excavation

1. Excavation consists of removal and disposal of excess material and unsuitable material encountered when establishing grade elevations. Remove unsuitable materials in accordance to the depth recommended by soils testing laboratory beneath structures to obtain the design bearing capacity.
    a. Dewater excavations for special inspector to observe and determine excavation limits.
    b. When bottoms of excavations are approved by soils testing laboratory, but are slightly unstable only in relation to Contractor operations or convenience, Contractor may, with approval of Engineer, provide a compacted gravel course utilizing materials acceptable to the soil testing laboratory. Such work shall be considered as for the Contractor's convenience and at Contractor's own expense.
2. Slope sides of excavations as required to provide stability and to comply with Federal, State and Local laws and regulations. Shore and brace excavation to avoid wetland impacts and when required by project conditions.
    a. Utilize cofferdams, steel sheet piling, shoring, underpinning, and other systems required to prevent damage to existing structures, settlement, slope stability problems, and undermining
    b. Remove construction related protection systems after their need is complete, in manner that will not loosen or damage soils, create slope stability problems, and otherwise damage existing and new structures. Leave construction-related protection systems in place subject to approval of Engineer, when their removal would create potential for damage to the soil conditions or to structures.
3. Excavate to required elevations and dimensions within a tolerance of plus or minus one tenth of a foot (0.10'), and extending a sufficient distance as required to provide for the work, completion of the structures, observation, and testing.
    a. When excavating for footings and foundations, do not disturb soil materials at and below excavation limits. Excavate by hand when necessary to prevent damage to soil materials that will remain.
    b. Trim bottoms to required lines and grades to leave solid dense base of required bearing capacity.
    c. Final removal limits shall be approved by soil testing laboratory prior to concrete placement.
4. Removal of materials beyond required subgrade elevations or dimensions without specific approval of soils testing laboratory as well as backfilling, compaction and remedial work recommended by soils testing laboratory at the over excavated area shall be at Contractor's own expense.
    a. Under structures and their components fill unauthorized excavation utilizing one of the following systems and as acceptable to Engineer:
        - Extend indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
        - Install lean concrete fill to bring elevations to required position.
        - Fill and compact unauthorized excavations with soil materials and to density required by Engineer.
    b. Elsewhere, backfill and compact unauthorized excavations as indicated for authorized excavations of same classification.

5. Protect excavation bottoms from freezing. Remove frozen materials and provide unfrozen compacted materials acceptable to Engineer prior to placement of materials on them.

B. Filling, Backfilling, and Compacting

1. Surface compact excavations where noted, prior to installing fill material.
2. Proof roll subgrade areas, where noted with, as a minimum, a tandem axle dump truck loaded to at least twenty five (25) ton weight. Truck shall traverse the structure footprint to detect areas of loose or soft soils. Loose or soft soils shall be defined as soils exhibiting "excessive rutting" from the truck tires (approximately one inch (1") wheel rut depth).
3. Do not place fill required below structures until soil conditions encountered have been approved by special inspector.
4. Do not place material on muddy surfaces, frozen ground or on materials containing frost or ice.
5. Do not place material on or in water.
6. Do not proceed with backfilling of excavations until completion of the following:
   a. Acceptance by Engineer of construction and structures below finish grade.
   b. Observation, testing, approval, and recording of locations of underground utilities.
   c. Removal of concrete formwork.
   d. Removal of shoring, bracing, other protection systems, and backfilling and compaction of voids left by their removals.
   e. Removal of unsuitable materials, construction related debris, and excess materials.
   f. Walls, including interior walls that brace exterior walls and intermediate floors and roof construction is installed, cured, and obtained required twenty eight (28) day compressive strength.
   g. When existing in-place soil materials are of density less than that specified, but the soil material is acceptable to Engineer, perform removal, filling, discing of ground surface, moisture-conditioning to the optimum moisture content, and compact to provide specified density and bearing capacity as recommended by soils testing laboratory and acceptable to Engineer.
7. Placement and Compaction
   a. Place materials in compacted layers of thickness required to obtain specified soil densities. Layers shall not exceed eight inches (8") or twelve inches (12") in loose depth for cohesive and cohesionless soil material, respectively, compacted by heavy compaction equipment and not more than four inches (4") or twelve inches (12") in loose depth for cohesive and cohesionless soil materials, respectively, compacted by hand operated tampers unless soil density tests substantiate specified densities will be obtained when material is placed in thicker lifts.
   b. Place material in lifts uniformly to the same approximate elevation, not exceeding the final grade height, in manner required to prevent creation of unbalanced soil lateral pressures, wedging action of materials and soil

pressures that exceed the design lateral soil conditions and to prevent damage to the structure.

c. Moisten or aerate each layer to the extent required to obtain the optimum moisture content required for the indicated compaction density. Prevent free water from appearing on surface during or subsequent to compaction operations.

d. Remove and replace with acceptable material, or scarify and air dry otherwise acceptable soil material that is too wet to obtain specified soil density. Assist drying by discing, harrowing, or pulverizing, until moisture content is reduced to value required for compaction.

e. Compact each layer to the required density specified for each area classification. Hand tamp or utilize hand operated vibratory equipment when required to compact material placed immediately adjacent to walls.

f. Do not place additional layers until density of each layer in place complies with compaction requirements. Perform corrective work as required to obtain required density. Cost associated with correction work and retesting at failed test locations shall be at Contractor's expense.

C. Compaction Requirements

1. Compact material to provide the following minimum percentages of Standard Proctor Density, tested in accordance with ASTM D698, at the area classification indicated:

a. Under structures including footings, mat foundations, slabs-on-grade, and exterior equipment and piping support pads: one hundred percent (100%).

b. In backfill zones under piping areas within twenty feet (20') of outermost edge of structures: one hundred percent (100%). See Section 2600 for further piping area compaction requirements.

c. In backfill zones in upper three feet (3') under roadway and pavement subgrade: one hundred percent (100%)

d. n backfill zones not indicated above: ninety five percent (95%) unless otherwise indicated.

D. The wet well and valve vault construction shall be completed in accordance with the plan sheets, standard details, and MnDOT specification 2506.3

3.03 PROCESS PIPE INSTALLATION

A. Piping shall be run as straight as practical along the alignment shown on the Drawings and with a minimum of joints. Piping and appurtenances shall be installed in conformance with reviewed shop Drawings and manufacturer’s instructions. Piping shall be installed without springing or forcing the pipe.

B. Thrust protection shall be provided as required. Flexible couplings shall be installed as connections to equipment, and where shown on the Drawings. Additional pipe anchors and flexible couplings beyond those shown on the Drawings shall be provided to facilitate piping installation, in accordance with reviewed shop drawings.

C. Piping components and indicators shall be installed in accordance with manufacturer's instructions. Required upstream and downstream clearances, valves, and miscellaneous devices as shown on the Drawings shall be provided for an operable installation.

D. Contractor shall provide materials and equipment necessary for the safe and timely installation of piping systems. Site shall be kept clean before, during and after pipe installation. Coordinate work with other trades.

E. Clean pipe before installation. Foreign matter shall be removed prior to installation.

F. Pipe Supports and Anchors
   1. Contractor shall provide hangers, supports and anchors for adequate support and pipe restraint for pipe, joints, fittings valves etc.
   2. Do not support piping from other piping.
   3. Hangers, supports and anchors shall be as indicated on the Drawings, and as required for compliance with MSS SP-69.

G. Pipe Flanges
   1. Pipe flanges shall be set level, plumb, and aligned. Flanged fittings shall be installed true and perpendicular to the axis of the pipe. The bolt holes shall be concentric to the centerline of the pipe.

H. Wall Penetrations
   1. Wall sleeves shall be securely supported by form work to prevent contact with reinforcing steel and tie wires.

3.04 BURIED PIPE INSTALLATION

A. Trench Excavation
   1. Trench excavation shall be to a depth that will permit preparation of the foundation as specified and installation of the pipeline and appurtenances at the prescribed line and grade, except where alterations are specifically authorized. Trench widths shall be sufficient to permit the pipe to be laid and joined properly and the backfill to be placed and compacted as specified. Extra width shall be provided as necessary to permit convenient placement of sheeting and shoring and to accommodate placement of appurtenances.
   2. When unsuitable foundation materials are encountered at the established grade, additional materials shall be removed as specified or ordered by the Engineer to produce an acceptable foundation. Refill trench to trench bottom grade with concrete, gravel, or other approved suitable material to assure a suitable foundation.
   3. Bottom trench widths shall allow for at least six inches (6") of clearance on each side of the joint hubs. The maximum allowable width of the trench at the top of pipe level shall be the outside diameter of the pipe plus two feet (2'), subject to the considerations for alternate pipe loading set forth below. The width of the trench at the ground surface shall be held to a minimum to prevent unnecessary disruption of the surface structures.
   4. The maximum allowable trench width at the level of the top of pipe may be exceeded only by approval of the Engineer, after consideration of pipe strength

and loading relationships. Alternate proposals made by the Contractor shall be in writing, giving the pertinent soil weight data and proposed pipe strength alternate, at least seven (7) days prior to the desired date of decision. Approval of alternate pipe deigns shall be with the understanding that there will be no extra compensation allowed for increase in material or construction costs.

5. If the trench is excavated to a greater width than that authorized, the Engineer may direct the Contractor to provide a higher class of bedding and/or a higher strength pipe than that required by the Contract Documents in order to satisfy design requirements without additional compensation.
6. Cut soil true and even so barrel of pipe will have a bearing for the full length. Trenches shall be sufficiently straight between designated angle points to permit the pipe to be laid true to line in the approximate center of the trench.
7. Trench excavation shall be made by open cut. Trench sides shall be as vertical as possible and trench shall be so braced, sheeted, and drained that work may be performed safely therein.

B. Sheeting and Bracing

1. Excavations shall be sheeted, shored, and braced as will meet all requirements of the applicable safety codes and regulations; comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces, foundations, structures, utilities, and other properties. Any damage to the work under contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, cave-ins, or other causes due to failure or lack of sheeting, shoring, or bracing or through negligence or fault of the Contractor in any manner shall be repaired at the Contractor's expense and without delay.
2. The Contractor shall assume full responsibility for proper and adequate placement of sheeting, shoring, and bracing wherever and to such depths that soil stability may dictate the need for support to prevent displacement. Bracing, sheeting, and shoring shall be so arranged as to provide ample working space and so as not to place stress or strain on the in-place structures to any extent that may cause damage.
3. Trench sheeting shall remain in place until pipe has been laid, tested for defects, and repaired if necessary, and the earth around it compacted in a minimum of one pass with vibrator equipment of a depth of one foot (1') over the top of the pipe. The sheeting, shoring, and bracing materials shall be removed only when and in such manner as will assure adequate protection of the in-place structures and prevent displacement of supported grounds. Sheeting and bracing shall be left in place only as required by the Contract Documents or ordered by Engineer. Otherwise, sheeting, and bracing may be removed as the backfilling reaches the level of respective support. Wherever sheeting and bracing is left in place, the upper portions shall be cut and removed to an elevation of three feet (3') or more below the established surface grade as the Engineer may direct.

C. Pipe Bedding

1. Pipe shall be laid upon sound, granular material (minimum of six inches (6")), cut true and even so that the barrel of the pipe will have a bearing for its full length.

2. If unstable material for bedding of pipe or trench backfill is encountered, notify the Engineer. Unstable material shall be removed and replaced with the foundation material specified herewith as may be ordered by the Engineer.

D. Pipe Laying

1. Installation of pipe and fittings.
   a. Installation of ductile-iron pipe and appurtenances shall conform to the requirements of AWWA C-600 Specifications and the Contract Documents.
2. Pipe shall be laid and maintained to the required line and grade.
3. All materials shall be handled carefully, as will prevent damage to protective coatings, linings, and joint fittings; preclude contamination of interior areas; and avoid jolting contact, dropping, or dumping.
4. While suspended and before being lowered into laying position, each pipe section and appurtenant unit shall be inspected by the Contractor to detect damage or unsound conditions that may need corrective action or be cause for rejection. Inspection procedures shall be approved by Engineer. The Contractor shall inform the Engineer of any defects discovered, and the Engineer will prescribe the required corrective actions or order rejection.
5. Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blisters, rough edges, or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.
6. Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper placement and joining of pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. All foreign matter or dirt shall be removed from the inside of the pipe and fittings before they are lowered into position in the trench, and they shall be kept clean by approved means during and after laying. The pipe materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.
7. When placement or handling precautions prove inadequate in the Engineer's opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of adjoining unit.
8. At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than necessary. No pipe material shall be laid in water nor when the trench or bedding conditions are otherwise unsuitable or improper.
9. Unless otherwise permitted by Engineer, bell and spigot shall be laid with the bell ends facing upgrade and the laying shall start on the downgrade and proceed upgrade. As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted around the pipe. Joint areas shall remain exposed and soil shall be prevented from entering the joint space until the joint seal is affected.

10. At all times when pipe laying is not in progress, including noon hour and overnight periods, all open ends of the pipe line shall be closed by watertight plugs or other means approved by the Engineer. If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.
11. Wherever it is necessary to deflect ductile-iron pipe from a straight line either in the vertical or horizontal plane, to avoid obstructions, plumb stems, or produce a long radius curve when permitted, the amount of deflection allowed at each joint shall not exceed the allowable limits for maintaining a satisfactory joint seal as given in AWWA C-600 for mechanical joints and push-on joints. The maximum angular deflection at any joint for other pipe materials and joints shall not exceed the manufacturer's recommendations. If the specified alignment requires angular deflections greater than recommended or allowed, the Contractor shall provide appropriate bends or shorter pipes such that the maximum angular deflection is not exceeded.
12. Contractor shall provide dewatering as necessary at no additional cost to the Owner. Contractor will be required to acquire the DNR Water Appropriations Permit if said permit is deemed necessary. Granular foundation material shall not be used in lieu of dewatering.

E. Backfilling in Pipe Zone
1. Backfill materials shall be carefully placed in uniform loose thickness layers up to twelve inches (12") thick, spread over the full width and length of the trench section to provide simultaneous support on both sides of the pipeline. Granular backfill free from rocks, boulders, or frozen material may be placed in twelve inch (12") layers above an elevation one foot (1') above the top of the pipe. Place and compact material to a minimum ninety five percent (95%) Standard Proctor Density.
2. Should the materials available within the trench section be unsuitable or insufficient for this portion of the backfill as determined by the Engineer, the Contractor shall provide and place an approved material as defined in this Specification.

F. Backfilling above Pipe Zone
1. Backfilling with suitable materials selected from the excavated materials to the extent available and practical. Contractor shall segregate undesirable materials encountered during excavation from suitable material.
2. Suitable materials are mineral soils free of rubbish, debris, frozen soil, oversize stone, concrete and bituminous chunks and other similar unsuitable material.
3. Place backfill materials in uniform depth layers not to exceed twelve inches (12") before compaction. Acceptably complete the compaction of each layer before placing material for the succeeding layer.
4. The intent of this specification is to compact the backfill enough to prevent large settlements above the pipe, but to use as little effort as possible to avoid disturbing the pipe and bedding at the pipe zone.
5. The method of means of placement and type of compaction equipment used is at the discretion of the Contractor. However, all portions of the trench backfill must meet the Engineer approval.
6. Any deficiency in quantity of backfill material will be furnished and installed by the Contractor at no additional compensation.

7. Excavated material not suitable or required for backfill is to be disposed of by the Contractor. Contractor shall remove the material from the site and dispose of said material according to applicable Federal, State, and local regulations. No additional payment will be made for disposal.
8. Trench areas beyond existing or proposed roadbeds and driveways shall be compacted by any method approved by the Engineer such that the final density will be ninety five percent (95%) Standard Proctor Density.
9. In those areas where the pipe lines are constructed in existing or proposed roadways, parking lots or other areas where settlement may cause structural damage to other utilities, the backfill shall be compacted as follows: Compaction requirements shall be ninety five percent (95%) Standard Proctor Density from the pipe zone to three feet (3') below finished grade, and one hundred percent (100%) Standard Proctor Density in the upper three feet (3') of the trench.
10. Tests to determine the compacted density of the backfill shall be ordered by Engineer if in Engineer's opinion the compaction is not adequate.

G. Restraining Pipe
1. All joints, including plugs, caps, tees, bends, and other thrust points shall be provided with restraining glands or tie rods.

3.05 PIPE PRESSURE TESTING

A. Interior lift station piping to be hydrostatically tested prior to applying insulation and/or paint. Hydrostatic testing to be performed at 150 pounds per square inch for at least two (2) hours, for each such test. If a pressure change or leakage is detected, the cause shall be determined and corrected by the Contractor at no additional cost to the Owner and the Contractor will retest the piping at no additional cost to the Owner.

B. Hydrostatic Testing of Pressure Force Mains
1. After the pipe has been laid, including fittings and valves and blocking, all newly laid pipe or any valved section thereof, unless directed otherwise by the Engineer, shall be subject to hydrostatic pressure of 150 pounds per square inch. The duration of each such test shall be at least two (2) hours.
2. Each section of pipe to be tested shall be filled with water and air expelled at the highest point. The required taps to expel air or to fill the water main shall be supplied and installed by the Contractor at no cost to the Owner and shall be three quarter inch (3/4") and shall include an approved service saddle when required.
3. The test apparatus shall be applied at the lowest elevation on the section to be tested. The apparatus shall be connected to the main at a service tap or special tap location.
4. The pressure gauge shall be a standard pressure gauge. The dial shall register from 0 – 200 psi and have a dial size of four and a half inches (4 ½") with one (1) psi increments.
5. The hydrostatic test, pressure requirement for an acceptable test shall be a maximum pressure drop of two (2) psi during the last hour of the two (2) hour pressure test. If this test requirement cannot be met, the Contractor shall investigate the cause, make corrections, and retest until the pressure drop requirement can be met.

C. Contractor shall be responsible for necessary safety precautions during testing.

D. Contractor shall notify Engineer seventy two (72) hours' prior to testing pipe.

3.06 START UP AND TESTING

A. A factory-trained service representative shall be present at the time when the station is to be put into service and turned over to the Owner. The service representative shall instruct the Owner in the proper operation and maintenance of the equipment. The service representative shall provide a minimum of eight (8) hours for installation, field testing, and training.

B. At the time of start-up, the Contractor shall conduct the necessary pumping test to determine the proper operation of the system. The Contractor shall furnish all meters, equipment and water required for these tests and the tests shall be so conducted as to check the operation of the pumping system. Necessary measurements of the electrical consumption shall be made to determine whether or not the pump is operating within the conditions recommended by the pump manufacturer. In the event that the tests show the equipment does not comply with the specifications of the pump manufacturer, this shall be sufficient cause to reject the pump and require the Contractor to remove it at no cost to the Owner. All tests therein required shall be supervised by the Engineer.

3.07 FIELD QUALITY CONTROL

A. Pre-operational Checks:
   1. Check pump and motor alignment.
   2. Check for proper motor rotation.
   3. Check pump and drive units for proper lubrication.

B. Startup and Performance Testing:
   1. Coordinate startup with installation of other related equipment.
   2. Operate pump using clean water at design point for continuous period of two hours, under supervision of manufacturer's representative and in presence of Engineer.
   3. Operate each pump at a minimum of two different flow rates as determined by ENGINEER.

C. Verify pump performance by performing time-drawdown test or time-fill test.

D. Check pump and motor for high bearing temperature and excessive vibration.

E. Check for motor overload by taking ampere readings.

F. Equipment Acceptance:
   1. Adjust, repair, modify, or replace system components that fail to perform as specified, and rerun tests.
   2. Make final adjustments to equipment under direction of manufacturer's representative.
   3. Document adjustments, repairs, and replacements in manufacturer's field services certification.

G. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day (8 hours)

on-Site for installation, inspection, field testing, and instructing Owner's personnel in maintenance of equipment.

H. Furnish installation certificate from equipment manufacturer's representative attesting equipment has been properly installed and is ready for startup and testing.

END OF SECTION 333211

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DIVISION 40 – PROCESS INTERCONNECTIONS

40 9000 Instrumentation and Control

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SECTION 40 9000 – INSTRUMENTATION AND CONTROL

PART 1 – GENERAL

1.1 GENERAL DESCRIPTION

A. Relocate the existing Dakota Supply Group supervisory control and data acquisition (SCADA) panel from the building at the lift station site to the new lift station control panel enclosure.

B. The SCADA panel shall be moved in its entirety, including its enclosure. The SCADA panel enclosure is 36” high x 30” wide x 12” deep.

C. Make 120vac connections to the SCADA panel. Make connections to the run and status outputs from the lift station control panel PLC as shown in the drawings and as described in specification 26 2419.

D. Relocate the existing Yagi antenna from the building to the new yard light pole at the new lift station. Furnish and install coaxial antenna cable from the antenna to the radio in the SCADA panel.

E. No internal wiring changes or programming changes are planned for the SCADA panel. It will continue to function in the same manner that it does currently for monitoring run and alarm information from the existing lift station controls.

PART 2 – PRODUCTS – Not used

PART 3 – EXECUTION

3.1 GENERAL

A. The SCADA panel shall be relocated and reinstalled as described above.

END OF SECTION 40 9000

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