

MUSKINGUM COUNTY WATER AND SEWER DISTRICT

SEWER DEPARTMENT

Construction Materials and Specifications



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CHAPTER I – GENERAL PROVISIONS

101 Scope

These specifications shall govern all construction performed and materials used in conjunction with constructing, installing, maintaining, and operating sewage systems which will be privately developed/constructed and publicly owned, operated, and maintained by the County, including service lines and components that provide wastewater to County’s systems, except when these specifications are superseded by more stringent requirements or specifications of another governing agency or government having jurisdiction over the Work being performed.

102 Plans and Specifications

The location and nature of the Work shall be illustrated in a complete set of construction drawings which shall be submitted to and approved by the County as an Exhibit to the Private Sewer Improvement Agreement. These specifications and the construction drawings prepared for the Work must be complete and provide all necessary details for construction. Any requirements called for in the specifications and not shown on the construction drawings or shown on the construction drawings and not called for in the specifications must be furnished by the Contractor as though appearing in both the construction drawings and specifications. If there is an apparent conflict or a conflict in fact between sections of the specifications or the specifications and the construction drawings as approved by the County, the most stringent information and interpretation shall prevail.

103 Reference Specifications and Drawings

When the American Society for Testing Material (A.S.T.M. Specifications), State of Ohio Department of Transportation Construction and Material Specifications (ODOTS CMS), Ohio Environmental Protection Agency (OEPA), and/or other specifications and standard drawings are referred to, such references shall be to the latest edition in effect on the date the construction drawings are approved (signed) by the District, unless otherwise noted. When such references are made, said specifications and drawings shall become a part of these specifications, except for Item 100 of the ODOT CMS.

104 Developer / Landowner to Meet Contractor Responsibilities

When a Developer/Landowner wishes to develop land by installing or causing the installation of sewer systems, which are intended to be privately developed/constructed and to be publicly owned, operated, and maintained by the County. The Developer/Landowner shall be responsible to the County for all things listed in the specifications as Contractor responsibilities.

105 Definitions

Whenever the words defined in this paragraph, or pronouns used in their stead, occur in these specifications, they shall have the meaning herein given:

105.01 Abbreviations: Whenever the following abbreviations are used in these specifications or on the Drawings, they are to be construed as meaning the following:

Abbreviation Table	
Organization	Abbreviation
American Association of State Highway and Transportation Officials	AASHTO
American Concrete Institute	ACI

American National Standards Institute	ANSI
American Society of Testing Materials	ASTM
American Public Water Association	APWA
American Water Works Association	AWWA
Code of Federal Register	CFR
Ohio Department of Commerce	ODOC
State of Ohio, Department of Transportation, Construction and Material Specifications	ODOT CMS
Ohio Environmental Protection Agency	OEPA
United States Environmental Protection Agency	EPA
Water Environment Federation	WEF

- 105.02 Agreement: The Private Sewer Improvement Agreement signed by the project owner and the county commissioners.
- 105.03 Contractor: The party entering into a contract with project owner, or authorized representatives legally empowered to act on that party's behalf.
- 150.03a Contract Documents: The Agreement, approved construction drawings, and Specifications.
- 105.04 County: Muskingum County Water and Sewer District, Muskingum County Sewer Department.
- 105.05 Engineer: Muskingum County Engineer, 155 Rehl Road, Zanesville, Ohio 43701; Phone 740-454-0155; FAX 740-455-7180
- 105.06 Owner: Muskingum County Commissioners.
- 105.07 Resident Project Representative (RPR): The person who assists the County with observing construction. This representative will be a County employee.
- 105.08 Specifications: The latest addition of these Construction and Material Specifications in effect on the date the construction drawings are approved (signed) by the County, the specifications included with the construction drawings, and any other requirements referenced in the specifications or construction drawings.
- 105.09 Work, The Work, The Project: All of the work to be executed and finished by one or more contractors in accordance with these specifications and the construction drawings as approved by the County.

106 Samples and Shop Drawings

Material samples, if required; a list of suppliers; and shop drawings, sketches, specifications, and descriptions required to establish compliance with these Specifications shall be submitted to the Engineer for approval prior to ordering, installing or using any equipment or material. Submission should be made at least 14 days prior to the date that approval is required. Construction cannot commence installation prior to approval of samples and shop drawings.

107 Progress Schedules

- 107.01 Before construction starts, the Developer/Contractor will submit an initial Progress Schedule in duplicate.
- 107.02 Developer/Contractor will submit a revised Progress Schedule when a major change in the projected schedule occurs.

108 Quality of Materials

Wherever particular brands or makes of material, devices or equipment are shown or specified, such items shall be regarded as standard. Any other brand or make of material, device or equipment which, in the opinion of the County, is the equivalent to that specified in quality, workmanship, economy of operation, and suitability for the purpose intended, shall be accepted. Acceptances of such items shall not be construed to remove the Contractor's responsibility to provide a complete, usable facility as specified herein and shown on the construction drawings.

109 Project Control

- 109.01 Authority of the County: The County shall observe the progress and quality of the Work and determine if the results of the Work are in general conformity with the Contract Documents. On the basis of on-site observations, the County shall endeavor to determine that apparent defects and deficiencies are not incorporated into the permanent Work, observations do not guarantee the performance of the Contractor. The County is not responsible for construction means, methods, techniques, sequences, procedures, time of performance, supervision, programs or for any safety precautions in connection with the Work. The County is not responsible for the Contractor's failure to execute the Work in accordance with the specifications or the construction drawings. The County may call upon the Engineer to assist with their responsibilities during the construction period. When requested, the Engineer will participate as described herein:
- a) The Engineer shall review and make recommendations to the County on questions of fact which may arise, including the quantity, quality or suitability of materials and equipment furnished, the work performance, and the progress of Work.
 - b) The Engineer may recommend corrections for any apparent or actual errors or omissions when such corrections are necessary for the proper fulfillment of the intention of the specifications and construction drawings.
 - c) Failure of the Engineer to observe or recommend rejection of any defective, unauthorized or non-conforming work or materials shall not in any way prevent later rejection when such defective, unauthorized or non-conforming Work or materials are discovered, nor obligate the County to final acceptance.
 - d) The Engineer may recommend suspension of Work wholly or in part due to the failure of the Contractor to correct conditions unsafe for workers or the general public, for failure to carry out provisions of the contract, and/or to carry out orders.
 - e) The Engineer may recommend suspension of Work for such periods as deemed necessary due to adverse weather conditions, conditions considered adverse to the performance of the Work or for any other condition or reason deemed to be in the public's best interest.

- 109.02 Control of Work and Materials: All Work and materials shall be subject to review by the County. The County or its representatives shall be provided access to all parts of the Work and shall be provided such information and assistance of the Contractor as is required to complete its review. The County may call attention of any observed defects of the Work, or materials which do not conform to the specifications or construction drawings at which time the Contractor shall immediately begin to correct defects of conforming items.
- Should the Contractor: fail to comply with the specifications or construction drawings, fail to provide certificates and/or proof of the suitability of materials or fail to prosecute the Work in a diligent and workmanlike manner, the Engineer may recommend to the County that the Contractor's operation be suspended on any or all portions of the project until such unauthorized, non-reviewed or defective work or materials are corrected.
- 109.03 Testing of Equipment and Materials: The taking of samples, testing of soils and concrete, and all other tests required by these specifications or because of the lack of certificates or proof of suitability of any materials shall be performed at no expense to the County and all costs shall be borne by the Contractor. All equipment and materials that have passed the prescribed tests may be incorporated in the work, provided that said equipment and materials meet all other requirements of the specifications and the construction drawings.
- 109.04 Watertight Structures: All structures to be used for holding water shall be made watertight and shall be tested by filling with water before they will be accepted. Tests of concrete water bearing basins shall be made before backfill is placed, however, where special reasons make this impractical the County may permit backfilling to proceed before the test is made. Permission to backfill shall not relieve the Contractor of any responsibility for watertightness of the structures and if upon making the test the need to remove backfill arises, it shall be done by and at the expense of the Contractor.
- 109.05 Plans and Construction Drawings: The Contractor shall keep a complete set of construction drawings and shop drawings on the project site at all times for review by the Engineer, County, and regulatory agencies.
- 109.06 Construction Layout Staking: Stakes showing the lines and grades necessary for the completion of the project shall be provided by a licensed Engineer or Surveyor. The establishing of horizontal and vertical controls for the applicable items of Work and the final measuring are the basic items to be provided. Cut-sheets showing the profile of the facilities in a format acceptable by the County shall be provided for all sewer line installations.
- 109.07 Authority and Duties of the RPR: Resident Project Representatives (RPRs) employed by the County or its designated agents will be authorized to observe all Work and materials furnished. Such authorization extends to all or any part of the Work and to the preparation, fabrication or manufacture of the materials to be used. The RPR is not authorized to alter or waive the requirements of the contract. The RPR is authorized to call the attention of the Contractor to any defect of the Work or materials in conformance to the specifications and construction drawings. The RPR is authorized to: refuse materials which do not meet specifications and require the portion of the Work involved be paused until any questions can be referred to and decided by the County General Manager. The RPR is not authorized to issue instructions contrary to the specifications and construction drawings or to supervise or act for the Contractor.
- 109.08 Notice and Fees for Tests and Inspections:

- a) The Contractor shall give at least 72 hours' notice, excluding weekends and holidays, to the County for required tests and inspection to be conducted. The Contractor shall furthermore ensure that no Work shall be covered or obscured prior to testing, inspection and acceptance by the County.
- b) The Developer, prior to the start of construction, pay the amount set forth in the Rules and Regulations to cover the cost of inspecting the improvements. As the project progresses, if additional inspection money is required, it will be requested by the County.

110 Maintenance Guarantee

For all County projects constructed using competitive bidding the correction period will be as stated in the contract documents for the specific project.

For other projects, all material and equipment placed and installed under these specifications shall be guaranteed by the Developer and its contractors as guaranteed by a Bond in the amount of the Work provided to the County against defects of material, workmanship, and design for a period of at least 2 years after the completion of the Work and acceptance by the County. Failure of the Developer to timely correct defects, improper designs, faulty workmanship and materials of the Work, shall entitle the County to correct the Work and to invoice Developer for the cost of making corrections, and any costs, and/or damages incurred by the Public. Failure of the Developer to pay invoices in 45 days will result in notice to the surety that issued the Bond.

110.01 Camera Warranty: The Developer shall clean and video record all sanitary sewer mainlines in accordance with NASSCO PACP requirements within the project at the time of deflection testing and approximately 60 days prior to the expiration of the 2-year Maintenance Guarantee period provided for herein. The Contractor shall arrange to have a County representative present during the televising of such infrastructure. A copy of the video shall be provided to the County in electronic format prior to the expiration of the Maintenance Guarantee period as outlined in the Agreement and prior to the final acceptance of the project, and release of the Bond.

111 Service of Manufacturer's Representative

When required by the construction drawings or specifications, the services of competent and experienced manufacturer's representatives shall be furnished to supervise the initial installation of material and equipment as well as to provide start-up and operational instructions to the County's personnel. Where the supervision by a manufacturer's representative is not called for, the Contractor is not relieved of his responsibility to properly construct or install material in accordance with the terms of these specifications or to provide start-up and operational instructions.

112 Notices

Notice shall mean written notice.

Written notice shall be deemed to have been duly served when delivered in person to the person, firm, officer, agent or representative of a party,

or

when delivered at the last known business address of such person, firm, agent, representative, when enclosed in a postage paid wrapper or envelope addressed to such person, firm, agent, or representative at his, their or its last known business address and sent by certified mail with return receipt requested.

113 Sanitation Regulations

Suitable on-site toilet facilities for the use of all persons employed on the project, properly screened from public observation, shall be provided and maintained by the Developer and its contractors. The Developer shall obey and enforce such other sanitary regulations and orders and shall take such precautions against infectious diseases as may be deemed necessary by the County.

114 Access to Abutting Properties

The Developer/Contractor shall provide and maintain temporary access to all properties where access is interrupted by its construction operations.

115 Inclement Weather Conditions

All Work which will be adversely affected by climatic conditions such as rain, wind, frost or temperature shall be suspended at the discretion of the County. Whenever Work proceeds under such conditions, the Contractor shall provide approved facilities for protecting all the materials and the finished Work. This shall include heating of materials if required for proper installation. No materials shall be installed during climatic conditions that do not meet manufacturer's recommendations.

116 Shoring Left in Place

In case any shoring, sheathing or bracing used in shoring trenches or other excavations is ordered left in place by the County, it shall be cut off as directed.

117 Utility Costs

The Contractor shall pay for the installation and use of all utilities such as water, gas, and electric service during construction and until final acceptance of the project by the County.

118 Compliance with Laws

The Contractor shall include, in all contracts for Work on the project, provisions requiring the Contractor or subcontractor(s) to:

- 118.01 Comply with all applicable laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss.
- 118.02 Erect and maintain, as required by existing conditions and progress of the project, all necessary safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying Owners and Users of adjacent utilities.
- 118.03 Provided for site safety and protection of materials, machinery and equipment.
- 118.04 Guard against or mitigate all hazards in accordance with the safety provisions of applicable state and federal laws, orders, findings, and regulations.
- 118.05 Exercise the utmost care and provide supervision from properly qualified personnel when using or storing explosives, paint, or other hazardous materials or equipment.

119 Protection of Finished Work

The Contractor shall be held responsible for any and all materials or Work and shall be required to correct at its cost, any injury or damage which said materials or Work may sustain from any source or cause whatever, before final acceptance thereof. This includes the Contractor's responsibility to mark utilities in order to protect the Contractor's materials or Work.

120 Contractor Not Released by Subcontractors

No subcontractor(s) shall, under any circumstances, relieve the Contractor of its liabilities and obligations to fulfill the requirements of these specifications.

121 Field Office

On projects by Developers, a field office may be provided for the use of the Developer, but is not required.

122 Safety and Health Provisions

The Contractor is bound by all provisions of the Federal Occupational Safety and Health Act of 1970 (OSHA), and all other applicable Federal, State, and local laws, regulations, findings, and orders relating to safety and health conditions on the work site. Construction methods shall be consistent with the Occupational Safety and Health Administration (OSHA) amended Construction Standards for Excavations, 29 CFR Part 1926, sub-part P, effective March 5, 1990 and amendments thereto.

123 Fasteners

All fasteners used for sewer construction shall be stainless steel unless approved by the County.

124 – 198 RESERVED

CHAPTER II – CONSTRUCTION MATERIALS

201 General

All material furnished by the Contractor shall conform to the minimum requirements of the latest edition of any referenced specifications in effect at the time of Bid opening, with exception of the ODOT CMS which shall be the 2019 edition, unless otherwise indicated.

202 Aggregate

Aggregate shall conform to the following items:

- 202.01 Aggregate for concrete shall meet the requirements of Item 703.02 (ODOT CMS).
- 202.02 Fine Aggregate for mortar shall meet the requirements of Item 703.03 (ODOT CMS).
- 202.03 Stone Aggregate shall conform in all respects to the specific kind described under Item 703 (ODOT CMS).

203 Brick and Masonry Units

All units shall conform to the requirements of Item 704 (ODOT CMS).

204 Cement and Concrete

- 204.01 Concrete shall conform to Items 499.02 and 499.03 (ODOT CMS).
- 204.02 Cement for mortar shall be as specified under the appropriate requirement for Item 701 (ODOT CMS).
- 204.03 Concrete incidentals shall conform to 705 (ODOT CMS).
- 204.04 Reinforcing steel shall be deformed bars conforming to Items 709.01, 709.03 or 709.05 (ODOT CMS). Bar mats and wire fabric shall conform to Items 709.09, 709.10 or 709.17 (ODOT CMS). The bar size number is specified on the construction drawings or on the standard drawings. The Contractor shall adhere to the methods of caring for, placing, bending, splicing, supporting, and protectively coating reinforcing steel as required by Item 509 (ODOT CMS).

205 Fence

All fabric, posts, wire fasteners, and incidental materials shall conform to Item 710 (ODOT CMS).

206 Iron, Steel, Metals, and Incidental Materials

- 206.01 All iron casting, structural steel, miscellaneous metals, and incidental materials shall meet the requirements of Item 711 (ODOT CMS).
- 206.02 Manhole steps shall be made of reinforced polypropylene plastic conforming to Item 711.31 (ODOT CMS). The steps shall be spaced as shown on the standard drawings or the construction drawings and cast or driven into walls of pre-cast risers and concave sections or mortared with a non-shrinking grout.

207 Sewer Pipe

207.01 Concrete Pipe: Only for gravity sewers 36 inches in diameter and larger.

- a) All non-reinforced concrete pipe shall meet the requirements of Item 706.01 (ODOT CMS).
- b) Reinforced concrete pipe shall conform to the requirements of Items 706.02, 706.03 or 706.05 (ODOT CMS).
- c) Rubber gasket joints shall conform to ASTM C 443.

207.02 Polyvinyl Chloride (PVC):

a) Pipe:

- 1) For sizes up to and including 15 inches in diameter at less than 20 feet of depth, PVC pipe shall conform to ASTM D3034 SDR 35, with a cell classification of ASTM B or C 12454 and joints meeting ASTM D3212 and gaskets meeting ASTM F477.
- 2) For sizes up to and including 15 inches in diameter at greater than 20 feet of depth, the PVC pipe shall conform to ASTM D3034 SDR 26, with a cell classification of ASTM B or C 12454 and joints meeting ASTM D3212 and gaskets meeting ASTM F477.
- 3) For sizes 18 inches in diameter and larger, the PVC pipe shall conform to ASTM F679 or ASTM F794 SDR 26, with a cell classification of ASTM B or C12454 and joints meeting ASTM D3212 and gaskets meeting ASTM F477.

b) Fittings/Caps/Plugs:

- 1) For sizes up to and including 15 inches in diameter at less than 20 feet of depth, PVC pipe fittings shall conform to SDR 35 gasketed heavy wall sewer fittings meeting ASTM D3034 and ASTM F1336, with a cell classification of ASTM B or C12454 and gaskets meeting ASTM F477.
- 2) For sizes 10 inches and smaller, a one-piece molded fitting is required.
- 3) For sizes up to and including 15 inches in diameter at greater than 20 feet of depth, the PVC pipe fittings shall conform to ASTM D3034 SDR 26, with a cell classification of ASTM B or C 12454 and joints meeting ASTM D3212 and gaskets meeting ASTM F477.
- 4) For sizes 18 inches in diameter and larger, PVC pipe fittings shall conform to SDR 26 gasketed heavy wall sewer fittings meeting ASTM F679, ASTM F794, and ASTM F1336, with a cell classification of ASTM B or C 12454 and gaskets meeting ASTM F477.

207.03 Ductile Iron Pipe: All ductile iron pipe shall conform to AWWA C151, with joints conforming to AWWA C111.

207.04 Adaptors for connecting pipes of dissimilar material and size and for connecting broken or cut sewer pipe shall be equivalent to those supplied by Fernco, Inc. Strong Back RC 5000 Series. Main line adaptors shall be ridged style and services may be flexible style. Each application shall be approved by the RPR on a case-by-case basis.

208 Manholes

All materials used in the construction or fabrication of manholes pertinent to sewer construction shall conform to Item 611.02 (ODOT CMS). All manholes and junction chambers for sanitary sewers shall be precast in accordance with Item 706.13 (ODOT CMS) unless otherwise approved by the County. All manhole, vault, and chamber joints shall be sealed with Conseal CS-202 or approved equal. All manhole frames for sanitary sewers must be equipped with a manhole chimney seal equal to Wrapidseal External Chimney Seal, or approved equal. Spectrashield epoxies are an approved equal to a Wrapidseal External Chimney Seal. The County requires an inside coating of Spectrashield epoxy on manholes that contain a drop or forcemain discharge connection. Any drop or forcemain discharge connection will require two manholes downstream to be installed with the same interior epoxy coating.

Drop entrances to sanitary sewer manholes shall be installed where indicated on the drawings and be constructed outside the manhole unless approved otherwise by the ENGINEER. No additional payment will be made for drop entrances to manholes. Drop entrances will vary in depth from a minimum of 2 feet to the maximum as indicated on the drawings. Drops shall be constructed of PVC pipe equipped with an approved outside drop system that includes stainless steel hardware. Bowl size shall be determined by incoming pipe sizes and flow rates. The bowl shall be installed as per the manufacturer's instructions using stainless steel fasteners. The appropriately sized drop pipe of SDR 35 PVC, Schedule 40 or other shall be securely attached to the manhole wall using stainless steel hardware. Drop entrances shall be of the same diameter as the sewer main from sizes 8-inch through 18-inch. For larger diameters, the drop shall be 18 inches unless otherwise specified in the SPECIAL PROVISIONS or shown on the drawings. Drop entrances for storm sewer manholes are not required.

If approved by the ENGINEER, inside drop entrances will be permitted. Inside drops shall be constructed of PVC pipe equipped with RELINER® INSIDE DROP SYSTEM and 316 stainless steel hardware. Bowl size shall be determined by incoming pipe sizes and flow rates. The bowl shall be installed as per the manufacturer's instructions using stainless steel fasteners. The appropriately sized drop pipe of SDR 35 PVC, Schedule 40 or other shall be securely attached to the manhole wall using stainless steel RELINER Adjustable Clamping Brackets and stainless-steel fasteners. Bracket interval shall be 4 feet maximum (minimum of 2 brackets). The connection of Drop Bowl to drop pipe shall be by flexible external pipe coupler. The turn-out at the base end of the drop pipe shall be accomplished with an appropriately angled PVC pipe elbow (45 degree recommended). Forcemain connections shall include Force Line Hood. Drop entrances shall be of the same diameter as the sewer main from sizes 8-inch through 18-inch. For larger diameters, the drop shall be 18 inches unless otherwise specified in the SPECIAL PROVISIONS or shown on the drawings.

All lids for manholes shall be Neenah Foundry R-1556 or R-1556-A, subject to the County's approval, with top surface alternate lettering "MUSKINGUM COUNTY SANITARY", or equal.

209 Sewer Pressure Pipe

209.01 Ductile iron pipe shall be Class 53 and conform to AWWA C151 with a minimum working pressure of 350 psi with joints conforming to AWWA C 111.

209.02 PVC SDR 21 ASTM D 2241 with a cell classification of 12454 B and joints in accordance with ASTM D 3139 and gaskets in accordance with ASTM F 477.

- 209.03 PVC AWWA C 900 DR18 with a cell classification as defined in ASTM D1784 of 12454 B or C for 4-inch to 12 inch and C 905 for 14 inches and larger.
- 209.04 High Density Polyethylene (HDPE) AWWA C901 or C906 ASTM PE 4710 DR9.
- 209.05 Unless otherwise shown on the construction drawings, all pipe shall be furnished with push-on type joints, such as Tyton, Fastite or approved equal. Joints shall be in accordance with NSI/AWWA C111/A21.11 and be furnished complete with all necessary accessories.

Fittings shall be ductile iron. Ductile iron fittings shall conform to either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Fittings shall have a standard asphaltic coating on the exterior. Fittings shall also have a cement mortar lining on the interior in accordance with ANSI/AWWA C104/A21.4.

Unless shown otherwise on the construction drawings, fittings and accessories shall be furnished with either mechanical or push-on type joints in accordance with ANSI/AWWA C111/A21.11.

JCM “Sure Grip” restrainers or approved equal shall be used on all mechanical joint fittings. Megalug restrainers may be used for Ductile Iron pipe or PVC pipe; Foster adapters may be used as approved equal.

All buried underground fittings shall have 316 stainless steel or “Cor-Blue” fluorocarbon hardware.

- 209.06 Metallic detectable underground solid 10-gauge wire shall be installed below and within 6 inches of all sewer force mains. Wire shall be green as specified by the APWA color code. At all valves, line beginnings and ends install Rhino TriView Flex & HideOut Tracing Wire Station with internal terminals that connect to the tracing wire. If the wire is spliced underground, it needs to be a DryCon connection.
- 209.07 Metallic detectable underground marking tape shall be installed above all sanitary sewer forcemains. Tape shall be green as specified by the APWA color code and shall be a minimum of 6 inches in width. The tape shall bear the words “CAUTION...FORCE MAIN” permanently printed on the tape. Tape shall be installed 18 inches to 24 inches below grade.

210 Underdrains

Underdrains shall conform to the following specifications:

- 210.01 Perforated Concrete Pipe, Item 706.06 (ODOT CMS).
- 210.02 Concrete Drain Tile, Item 706.07 (ODOT CMS).
- 210.03 Vitrified Clay Pipe, Item 706.08 (ODOT CMS).
- 210.04 Clay Drain Tile, Item 706.09 (ODOT CMS).
- 210.05 Perforated Polyvinyl Chloride Pipe, Item 707.41 (ODOT CMS).
- 210.06 Heavy Duty Corrugated Polyethylene Slotted Drain, ITEM 707.33 (ODOT CMS).

211 Steel Casing Pipe

Casing pipe shall be steel pipe meeting ASTM specifications, 35,000 psi yield strength and 60,000 psi tensile strength, or approved equal, to serve as a casing for sewer and shall be installed within the limits and at the location shown on the Drawings. The casing pipe shall be bituminous coated inside and out and conform to ASTM A 123. Steel casing pipe shall have a minimum wall thickness as indicated on the Standard Construction Drawings, unless otherwise approved by the County. Nylon casing spacers or casing spacers meeting Power Seal, Type 304 Stainless Steel, or Advanced Products Systems, Model SSI Stainless Steel, or approved equal shall be used in positioning the carrier pipe within the casing pipe.

212 Valves

212.01 Gate valves with a non-rising stem, left hand open (counterclockwise) with double O-ring stem seals. Valves shall have end joints conforming to AWWA C111. Valves shall pass a seat test at a pressure of 250 psi without leakage. The valve shell shall pass a shell test with the valve in the open position at a pressure of 400 psi without leakage through metal, flanged joints or stem seals. Additionally, the valves shall conform to one of the following:

- a) AWWA C509 having a sealing mechanism that provides zero leakage at the water working pressure against line flow from either direction. No exposed metal seams, edges, screws, etc. shall be within the waterway in the closed position (all surfaces shall be rubber covered). The rubber covered gate shall not be wedged in a pocket nor slide across the seating surface to obtain tight closure. All internal and external ferrous surfaces, including the interior of the gate, bolt holes, and flange faces, shall be coated prior to assembly of the valve with epoxy having a minimum thickness of 8 mils. There shall be an O-ring seal above the storm collar, and an O-ring seal below the stem collar with the area between the O-ring seals filled with lubricant. There shall be anti-friction washers at the stem collar.

212.02 Butterfly valves left hand open (counterclockwise) conforming to AWWA C504 for Class 150B. Valve bodies shall be cast iron per ASTM A126, Class B. Flanged valves shall be of the short body design with 125-pound flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges. Mechanical joint ends shall meet the requirements of AWWA C110/ANSI A21.11. Discs shall be offset to provide an uninterrupted 360-degree seating edge and shall be cast iron per ASTM A48, Class 40 or ductile iron per ASTM A536. The disc seating edge shall be 316 Stainless Steel. The disc shall be securely attached to the valve shaft using 304 Stainless Steel pins. The valve shaft shall be of type 304 Stainless Steel. The seat shall be of acrylonitrile butadiene and shall be bonded or vulcanized in the valve body. The use of fillers to increase seat compression is not acceptable. Valve shaft seals for 3-inch to 24-inch valves shall be of self-compensating V-type packing. The interior of the body shall be lined with the same material as the seat. Each valve shall be factory tested per AWWA C504, with the actuator assembled to the valve.

212.03 Valve Boxes shall be of the 5¼ inch shaft two-piece screw type equivalent to Bingham & Taylor Model 4905, Size 22, or approved equal. Valve Boxes in traffic areas shall be the Heavy-Duty Type. Valve Box shall be marked "SEWER" for sanitary sewer forcemains.

213 Manual Air Relief Assembly

213.01 Service saddle:

- a) PVC force mains 12-inch and smaller: Stainless steel saddles with AWWA threads as manufactured by Ford Meter Box Co., or approved equal.
 - 1) ASTM C2241 (IPS) Style S70
 - 2) AWWA C900 (DIPS) Style S 90
 - b) DIP Mains: Style FC202 iron service saddles with AWWA tapered threads, as manufactured by Ford Meter Box, Co. or equal.
- 213.02 Corporation stop: Ball corporation stop, no-lead brass, Ford Meter Box, Co. 1-inch FB600-4-NL with L04-44-G-NL quarter bend.
- 213.03 Isolation valve: Ball valve curb stop, Ford B41-444M-G-NL.
- 213.04 Pipe: Polyethylene service tubing, one-inch, CTS.
- 213.05 Box and Cover: 18-inch x 30-inch Mid-States HDPE Meter Box with Ford Meter, Co., Model C52 cover with 15-inch lid opening and 4-inch depth for 18-inch diameter meter boxes, or approved equal.

214 Sewage Combination Air Valve

- 214.01 Product/Manufacturer: Sewage Combination Air Valve 0Series 440 SCAV, as manufactured by AFCO; Model D26 as manufactured by A.R.I. USA, Inc.; or equal with features and appurtenances described herein.
- 214.02 Sewage Combination Air Valve: ASTM A26 Class B cast iron with fusion-bonded epoxy coated interior and exterior, elongated body designed to exhaust large quantities of air during filling, closing upon liquid entry; open during draining or negative pressure and release accumulated air while the system is pressurized; performing functions of both Wastewater Air Release and Wastewater Air/Vacuum Valve; suitable for pressures to 150 psig; manufactured and tested in accordance with AWWA C512.
- 214.03 Air Valve Size: As indicated on drawings. full size NPT inlet and NPT outlet with full port orifice and double guided plug, with precision orifice frilled through center stem. Orifice to be sealed by an adjustable threaded resilient orifice button on the cover.
- 214.04 Internal compound lever mechanism of molded Delrin with remaining internals of stainless steel.
- 214.05 Stainless Steel Float; ASTM A240, capable of withstanding 150 psi minimum.
- 214.06 Appurtenances: Valve to be fitted full-port stainless ball blow-off valves, stainless steel nipples and quick disconnect couplings and minimum 10 foot of hose, to permit back flushing after installation without dismantling valve.
- 214.07 Isolation valve: Eccentric Plug Valve with non-lubricated manual operator; 150 psi rated working pressure; ANSI 125 lb. flanged ends; the valve body away from the valve seat; fully adjustable plug position stops; valve shaft shall be designed to allow two O-rings for four packing rings; stuffing boxes and packing glands shall be designed to allow adjustable placement of packing without disassembly of valve or operator; DeZurik Series 100, Figure 118, or approved equal. Stainless steel fasteners and epoxy coatings (all spec)

215 - 299 RESERVED

CHAPTER III – GENERAL CONSTRUCTION REQUIREMENTS

301 Description

This section describes the general work required for furnishing and installing underground conduits and the associated equipment, material, and labor necessary to provide complete and usable public sanitary sewer lines.

302 Trench Excavation

Trenches shall be excavated to a width sufficient to allow for proper jointing and placing of the conduit. To a point 12 inches above the top of the conduit, the trench walls shall be vertical and shall not exceed the dimensions shown on the construction drawings or the standard drawings. Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workers or the public, or obstruct sidewalks, driveways, roadways or other structures.

- 302.01 Unsuitable Material: The foundation for the conduit bed shall be firm for its full length. Where unsuitable material is encountered, it shall be removed to the depth directed by the County and for a width on each side equal to the diameter or span of the conduit and replaced with Type A or Type B backfill as defined in Section 305. Rock or boulders encountered at the conduit bed shall be removed at least 6 inches below the bottom of the conduit and replaced with granular bedding.
- 302.02 The Contractor shall be responsible for undercutting of unsuitable material to a point 12 inches below the original grade. Additional excavation beyond 12 inches, provided it is not due to the fault or neglect of the Contractor, shall be approved by the County.
- 302.03 Conduit in Embankment: When a conduit is to be placed within an embankment or the top of the conduit is above the existing ground, the embankment shall be constructed to a point at least 2 feet above the top of the conduit, in accordance with the requirements of Item 203 (ODOT CMS), before trenching for the conduit.
- 302.04 Excess Excavation: Unless otherwise stated on the construction drawings, the Contractor shall dispose of all excess excavation at his own expense. The material shall be disposed of in a manner that meets all local, state, and federal regulations.
- 302.05 Blasting Procedures: When it is necessary to resort to blasting with explosives, the Contractor shall use the highest degree of care and adequate protective measures so as not to endanger life, completed portions of the project, and all other property, both public and private. Before conducting any blasting operations, the Contractor shall furnish the County, in writing, a schedule of intended blasting operations and shall give the County prior written notification of any changes in such schedule. The responsibility of the Contractor with respect to the use of explosives in blasting includes compliance with all laws, rules, and regulations of local, state, and federal agencies, the state fire marshal, and the insurer which governs the storage, use, manufacturing, sale, handling, transportation, and other dispositions of explosives. The Contractor's operations shall be conducted with every precaution by trained, reliable personnel under satisfactory, experienced supervision. No blast shall be fired until all persons in the vicinity have had notice and reached positions out of danger. The Contractor shall be responsible for any and all damages resulting from the use of explosives. All firing shall be done by electric means only, and the Contractor shall make suitable provisions to prevent the scattering of broken rock, earth, stones or other material during blasting operations.

- a) All blasting operations shall be covered by public liability and property damage insurance with copies of such insurance certificates furnished to the Owner.
- b) Except in the case of continuous tunnel operations, all blasting shall be limited to specified daylight hours.

302.06 Pavement Removal: Removal of pavement and road surfaces shall be part of the trench excavation. The amount removed shall depend on the width of trench required for installation of the pipe and the dimensions of the area into which valves, hydrants, manholes or other structures will be installed. The dimensions of pavement removed shall not exceed the dimensions of the opening required for installation of pipe, valves, hydrants, manholes or other structures by more than 4 feet in any direction, unless otherwise stipulated in the Drawings. Methods such as sawing or drilling shall be used to ensure the removal of pavement along straight lines. All appropriate permits of local jurisdiction shall be secured by the Contractor prior to any pavement removal.

303 Removal of Water

The Contractor shall, at all times during construction, provide proper and satisfactory means and devices for the removal of all water entering the excavations and shall remove all such water as fast as it may collect in such a manner as shall not interfere with the prosecution of the work or the proper placing of masonry or other work. Discharges from the trench dewatering system shall be directed away from the trench in order not to affect the trench stability and shall be filtered through appropriate siltation devices meeting local or state codes prior to entering drainage ways or streams. The Contractor shall not dispose of ground and/or surface water into newly constructed or existing water lines or sanitary sewers unless specifically approved by the County. The Contractor shall, at the end of each day, place a watertight plug or cap at the end of the last joint to prevent water and/or materials from entering into the system. The plug or cap shall not be removed until the excavation is dewatered.

The Contractor shall submit a dewatering plan to the County prior to construction. The Contractor is responsible for all local, state, and federal withdrawal permits, reporting, and maintenance associated with the removal and discharge of said water. The Contractor will be required to clean all conduits that were utilized to convey and promote removal of water to the satisfaction of the County.

304 Bedding

All conduits shall be laid on bedding as described in these specifications and shown on the Standard Construction Drawings. Unless otherwise shown, bedding shall be Class B. The bedding classifications are as follows:

- 304.01 Class A bedding shall be Class C (ODOT CMS 2010) concrete, plain or reinforced, as specified on the Drawings and meeting the following minimum requirements.
- a) The concrete shall extend from the bottom of the trench, which shall be no less than 6 inches below the bottom of the conduit, to the springline of the conduit.
 - b) The concrete shall extend to the full width of the trench which shall be a minimum of 4 inches horizontally beyond the outside diameter on each side of the conduit or have a minimum overall width centered on the conduit of 1¼ times its outside diameter, whichever is greater.

- 304.02 Class B Bedding shall be granular material as shown on Table 703.01-1 (ODOT CMS), No. 57 aggregate, extending from a point 6 inches below the bottom of the conduit to a point 12 inches above the top of the conduit.
- 304.03 Class C Bedding shall be natural undisturbed soil free from stones larger than 1.5 inches, topsoil, vegetation, debris, rubbish, peat or frozen material and shaped to fit the pipe with recesses shaped to receive the bell.
- 304.04 When the trench is excavated below the proposed grade the excess depth shall be filled with Class A or B Bedding material.

305 Backfill / Trench Dams

All trenches and excavations shall be backfilled as specified herein as soon after the sewers or other structures are completed and the particular type of construction and the circumstances will permit.

- 305.01 The type of backfill shall be:
- a) Type A: Granular material as specified in 703.11 (ODOT CMS), Structural Backfill Type 3, No. 57 shall be required.
 - b) Type B: Natural soil free from stones larger than 2 inches across their greatest dimensions, topsoil, vegetation, debris, rubbish or frozen material.
 - c) Type C: Natural soil free from stones larger than 2 inches across their greatest dimension, vegetation, debris, rubbish or frozen material.
 - d) Type D: Low Strength Mortar Backfill per Item 613 (ODOT CMS).
- 305.02 Unless the type of backfill is specified herein or on the construction drawings as either Type A backfill, Type C backfill or Type D backfill, or unless otherwise specified, it shall be understood to mean that Type B backfill may be used, whether actually specified on the construction drawings or not.
- 305.03 The backfill under and/or within 5 feet of existing or proposed roadways, paved shoulders, curbs, sidewalks, existing parking areas, and drives shall be Type A. Type D backfill shall be used when specified in the Standard Construction Drawings.
- 305.04 When concrete bedding or encasement is used, the trench or excavation shall not be backfilled for at least 24 hours after placing the concrete, except that the conduit may be covered to a depth not to exceed 12 inches in order to afford protection. The method employed in depositing the backfill shall be such as to prevent damage to the concrete cradle, sewer or other structures.
- 305.05 All backfilling operations and placement of the backfill material shall be conducted so as to protect the conduit, its appurtenances, and structures from damages. Equipment which will cause the trench loads to exceed the pipe strength, shall be kept at least 5 feet away from the trench.
- 305.06 When Type A Backfill is called for, the material shall be placed and compacted using water if drainage is provided or mechanical tampers so as to obtain 98 percent of its maximum, laboratory dry weight. Approval of water prior to its use shall be obtained from the County.

When Type B Backfill is called for, the backfill shall be carefully selected, carefully placed, and compacted to 95 percent of its maximum laboratory dry weight as determined in accordance with Item 203 (ODOT CMS). When Type C Backfill is permitted the backfill shall be carefully placed and compacted to 90 percent of its maximum laboratory dry weight as determined in accordance with Item 203 (ODOT CMS). Type D backfill shall be installed per Item 613 (ODOT CMS). Compaction tests shall be provided by the Contractor as requested by the County to verify backfill compaction complies with these requirements. The Contractor shall bear all costs for this work.

- 305.07 Regardless of the backfill method used or testing results obtained, the Contractor shall be responsible to correct any settlement or deterioration of the backfill and restore the area.
- 305.08 Concrete structures built in place shall not be backfilled until permitted by the County.
- 305.09 All Type A backfill shall be compacted by mechanical vibratory equipment.
- 305.10 Trench dams shall be required when specified in the Drawings or directed by the County. Trench dams shall consist of predominately clay soil or a mixture of predominately clay soil and bentonite. Trench dams are to be constructed on all sanitary sewer gravity main lines at intervals not to exceed 400 feet and shall be located approximately 25 feet upstream of manholes, lift stations, and other structures. Trench dams shall also be located the same distance downstream of storm ditch crossings or underground water sources or as directed by the County. Trench dams shall not be installed at wyes, risers, laterals, utility crossings, pavement crossings or granular backfill areas. The minimum length of an individual trench dam shall be 5 feet. The width shall extend fully from the excavated trench wall to the opposite excavated trench wall. The height of trench dams shall extend from the excavated trench bottom to within 2 feet of the existing ground surface.

Trench bottoms within the proposed trench dam area may be excavated by machine to the proposed pipe springline. The area shall then be carefully excavated by hand or similar means so as to accommodate and properly support the pipe without the use of bedding aggregate and properly support the pipe with a predominately clay material.

The area above the installed pipe shall be backfilled with clay and/or bentonite materials. The placement and compaction of the backfill shall be in accordance with Item 203 (ODOT CMS). The method of installation shall also conform to the pipe manufacturer's published recommendations.

Deviations from any of the above listed requirements shall not be allowed without a written request from the Contractor and consequent written approval by the County. The cost for this work shall be included in the price bid for other various related items.

Trench dams shall also be provided immediately upstream of the main line sewer on all service connections at the time of the construction of the service connection.

306 Concrete Backing

Wherever called for or shown on the Drawings, the Contractor shall provide and place Class C (ODOT CMS 2010) concrete backing in accordance with the Standard Construction Drawings.

307 Concrete Encasement

Wherever called for on the construction drawings, the Contractor shall provide and place Class C concrete encasement as shown on the Standard Construction Drawings. If encasement is required, concrete shall completely surround the pipe and shall have a minimum thickness of $\frac{1}{6}$ of the inside diameter of the pipe or 6 inches, whichever is greater. Class C (ODOT CMS 2010) concrete shall be used with an ultimate compressive strength of no less than 4000 psi at 28 days.

308 Stream Crossing

The crown of all sewers crossing the streams shall be sufficient depth below the natural bottom of the stream bed. The minimum cover over the crown of the pipe shall meet the following requirements:

308.01 Four (4) feet of cover and concrete encased per section 307.

The crossing shall be free from change in grade and the sewer should be designed to cross the stream as nearly perpendicular to the stream flow as possible.

309 Tunneling and Jacking

This work shall include the furnishing of all labor, equipment, and material necessary to install tunnels, boring, and jacking as shown on the Drawings. Work includes all clearing and grubbing; removal and restoration of fences, sidewalks, pavements, and other property; excavation; grouting and pumping sand or other granular material inside and outside the tunnel or bore as described herein; providing all liner plates, steel pipe or conduit, grout, sand or granular material; providing and removing all dewatering and pumping systems; all shoring, cribbing, and sheeting, testing, and other work associated and required to provide a complete, usable tunnel.

309.01 Other Requirements and Permits: All work within the right-of-way of private companies and public agencies shall conform to the requirements and regulations of the respective companies or agencies. The Contractor shall obtain permits for any railroad, local, state or federal highway crossing, shall coordinate scheduling of construction of such crossings with railroads and highway departments, and shall pay any charges established therefore for work accomplished by those companies or agencies. Special construction requirements defined by railroads or highway departments shall be adhered to by the Contractor. A copy of the permit or approval from the respective companies or agencies shall be furnished to the County prior to starting work within the right-of-way.

309.02 Tunneling: Casing Pipe shall conform to Section 211. In excavating the tunnel, care shall be exercised to trim the surface of the excavated section to a true line and grade with the excavation conforming to the outside of the tunnel plates as nearly as possible. In the installation of tunnel or shaft liner, the length of unsupported tunnel or shaft shall be no greater than $1\frac{1}{2}$ times the laying length of a liner plate or pipe. Liners shall be placed promptly as excavation permits. Upon the completion of any ring of liner plates, bolts shall be retightened in the 2 rings previously completed. Should the top half of the tunnel excavation be supported by cutting shield, excavation shall not advance beyond this support. The vertical face of the excavation shall be supported as necessary, to prevent sloughing and interruptions to the tunneling operations.

309.03 Borings: Installation of steel conduit by the boring method shall be done using an auger type boring machine or a machine of such a design as to meet the individual requirements of the railroad, local, state or federal highway system being crossed. The Contractor shall provide an approach pit, completely sheathed and of sufficient size to accommodate the lengths of conduit and the operation of the boring equipment. The operation of the boring equipment

shall be subject to continuous checking by the Contractor to ensure proper alignment of the encasement pipe.

- 309.04 Jacking: The Contractor shall provide an approach pit for the jacking operation, excavated so that the jacking face is a minimum of 3 feet above the conduit. This open face will be shored securely to prevent displacement of the embankment. The pit shall include a backstop of sufficient size to take the thrust of the jack. Care shall be exercised in placing the guide rails to ensure that the conduit will be accurately constructed to line and grade. The entire approach pit shall be sheeted. Hydraulic or mechanical jacks may be used in this operation. The number and capacity of the jacks shall be adequate to complete the operation. A jacking head shall be used to transfer the pressure from the jacks and the jacking frame to the pipe. If an auger is used, the pipe shall be jacked simultaneously with the augering. The construction work shall be checked by the Contractor at frequent intervals to insure proper line and grade of the installation.
- 309.05 Grouting: Any space existing outside the casing pipe shall be grouted at low pressure through grout holes provided in a sufficient quantity in the liner. These holes shall be installed in suitable locations so that grouting can be done effectively. The pressure grouting shall preferably begin at the lowest middle hole of each grout section, the grout holes above being open, and proceed upward progressively and simultaneously on both sides of the tunnel. Grouting shall be done as near the end of the line as practicable and, if deemed necessary, grout stops shall be placed behind the sections at or near the end of the erected lining to permit grouting to or near the end.
- 309.06 End Seals: Rubber end seals shall be installed in accordance with Advanced Products and Systems Model AW Wrap Around End Seal or approved equal.

310 Directional Boring

Sanitary sewer mains and force mains shall be installed by directional boring where shown on the Drawings. Sewer mains and force mains may be installed under pavement or ground surfaces through directional drilling practices in lieu of open-cut excavation. The limits of the directional boring shall be as shown on the Drawings. Substitution of open-cut excavation for directional boring shall be approved by the County prior to performance. All excavation work shall be performed beyond the edge-of-pavement per the permit requirements. For directional borings on sanitary sewer or force mains casing pipe is required if specified in the permit.

- 310.01 Materials: The pipe shall be HDPE (AWWA C-906) PE 4710 resin as specified in ASTM D 3550 for sanitary sewer mains and force mains. The HDPE pipe shall be ductile iron pipe size and have a minimum rating of SDR9 unless the manufacturer's recommendations require a thicker wall. The internal diameter of the HDPE main shall be equal to or greater than that of the open-cut excavation material in which connection or transition is made. A weld on mechanical joint adapter with integral stiffener must be used when transitioning to PVC or ductile iron pipe. The HDPE sanitary sewer main and forcemain shall have a green identification band. Certa-lok Yelomine restrained joint PVC pressure pipe meeting ASTM 2241 with a cell classification of 12454, or approved equal shall be used for sanitary sewer mains and may be used for force mains. The pipe shall have a minimum rating of SDR 21 unless the manufacturer's recommendations require a thicker wall.
- 310.02 Fittings: The fittings used to transition between the open-cut excavation material and the directional boring material shall be as recommended by the manufacturer. If HDPE pipe is transitioned to PVC or ductile iron, three pipe joints located both upstream and downstream

must be restrained. If it is found that the pipe manufacturer's restraining requirements are more stringent, the manufacturer's specifications must be followed.

- 310.03 Qualifications: The directional drilling contractor shall have actively engaged in the installation of pipe using guided boring for a minimum of 3 years, with at least 3 projects in similar ground conditions and with similar size and length. The field supervisory personnel employed by the directional drilling contractor shall have at least 5 years' experience in the performance of work. Written proof of qualifications should be submitted and approved by the County prior to construction.
- 310.04 Tracer Wire: 2 insulated 8-gauge, solid copper wires green as specified by APWA color code shall be installed with the pipe for locating purposes. At each end of a bored section, wire shall be clamped with a brass connector to a 3-foot piece of ½" rebar. Wire shall be pulled back through the bored hole with the pipe and tested for continuity. The top of the rebar shall be installed 2-inches above the ground at each end of the bore.
- 310.05 Testing: The finished main shall be tested in accordance with Sections 408 of these Specifications. Mains not holding the specified pressure for the test duration shall be removed from the hole, repaired or replaced and installed and tested again.
- 310.06 Pilot Hole: The Contractor shall follow the pipeline alignment as shown on the Drawings. If adjustments are required, the Contractor shall notify the County for approval prior to making the adjustments. In the event of difficulties at any time during boring operations requiring the complete withdrawal from the tunnel, the Contractor shall be allowed to withdraw and abandon the tunnel and begin a second attempt at a location approved by the County.
- 310.07 Installation: After the pilot hole is completed, the Contractor shall enlarge the hole, if needed, by pre-reaming, and install a swivel to the reamer and commence pullback operations. Reaming diameter shall not exceed 1½ times the diameter of the product pipe being installed. Site Windows may be required to be excavated by Contractor at the crossings of other utilities for viewing of crossings. The product pipe being pulled into the tunnel shall be protected and supported so that it moves freely and is not damaged by debris on the ground during installation. Pullback forces shall not exceed the allowable pulling forces for the pipe material. The Contractor shall supply documentation from the pipe manufacturer verifying allowable pulling force. The thickness of the pipe shall be increased, at no additional costs, if pullback forces are anticipated to exceed the allowable pulling force on the specified pipe.
- 310.08 Drilling Fluid: Drilling fluid shall be a mixture of water and Bentonite clay or other County approved mixture. The fluid shall be inert. Disposal of excess drilling fluid and spoils will be the responsibility of the Contractor who shall comply with all relevant regulations and permit agreements. Excess drilling fluid and spoils shall be disposed of at an approved location. The Contractor is responsible for transporting all excess drilling fluid and spoils to the disposal site and paying any disposal costs. Excess drilling fluid and spoils shall be transported in a manner that prevents accidental spillage onto roadways. Excess drilling fluid and spoils shall not be discharged into sanitary or storm systems, ditches or waterways. Drilling fluid returns (caused by fracturing of formations) at locations other than the entry and exit points shall be minimized. The Contractor shall immediately clean up any drilling fluid that surfaces through fracturing.
- 310.09 Acceptable Deflection and Grade: Force mains shall have no deflection which exceeds the manufacturer's recommendation for the approved and installed material. Sanitary sewer

lines shall be within 0.1 foot of desired grade at either end and have a “Belly” of no more than 0.1 foot. This shall be measured by filling the pipe with water, letting it drain, and televising the line. Installations that do not meet these acceptable tolerances will be considered insufficient and re-installation will be required.

310.10 As-Builts: An as-built survey of the plan and profile for the installed main shall be submitted at 25 foot intervals. These elevations at the prescribed intervals shall be taken during installation of the pilot hole.

311 Miscellaneous Work

All items of work called for on the Drawings or in these Specifications for which no specific method of payment is provided shall be performed by the Contractor and the cost of same shall be included in the price bid for the various related items.

312 Field Tile

All field tile and storm sewer broken during excavation shall be replaced with material equal to or better than its original condition unless otherwise authorized by the County.

313 Temporary Pavement Replacement

Temporary pavement replacement shall be provided for permanent pavement damaged or removed by the Contractor in the performance of the work to limits shown on the construction drawings or ordered by the County. Temporary pavement shall be installed as soon as the trench has been backfilled. The County may require that all materials and equipment incidental to providing the temporary pavement be on the job site prior to removing the existing pavement. Unless otherwise approved by the County, the temporary pavement shall be as shown on the Drawings. Temporary pavement shall be maintained by the Contractor until permanent pavement is installed.

314 Permanent Pavement Replacement

The pavement shall be replaced by first removing the temporary pavement down to the clean granular material and removing the existing pavement for at least 12 inches beyond the trench limits on each side. The pavement to be removed shall be neatly sawed, not more than 72 hours prior to the placing of permanent pavement materials. The permanent pavement materials and workmanship shall be at least equivalent to the existing pavement being replaced, as determined by the County. After removal of the temporary pavement and sawing of the existing pavement edges and prior to the placing of the permanent pavement, Tack Coat, Item 407 (ODOT CMS), shall be applied to the exposed existing pavement edges, and Prime Coat, Item 408 (ODOT CMS), shall be applied to the base material and Seal Coat, Item 423. Type 1 (ODOT CMS), shall be applied to the surface of the final asphalt coat at the sawcut.

315 Traffic Control

The Contractor shall submit a plan and schedule for detouring traffic 10 days prior to the closing of any road. Any temporary closing of a road does not relieve the Contractor of the responsibility to provide access to the property by emergency vehicles and the property owners.

Where it is anticipated that work will close a road, the Contractor shall inform the agency in control of the right-of-way, the local law enforcement agency, the local Fire Department, the County Engineer, County Sheriff’s Department, School County, and the County as to the extent, nature, and time of the

closing. The Contractor shall post pre-closing notification signs along the road(s) to be closed one week in advance and shall have a notice printed in a local newspaper 3 days prior to the closing, stating the extent, nature and time of the closing. Adequate lights, signs, flagmen, and barricades shall be used as required in Item 614 (ODOT CMS) to safeguard the traveling public at all times. No road shall be closed until the schedule is approved by the County and the agency in control of the right-of-way. No existing traffic flow shall be altered until the Contractor submits in writing a request for approval of the alteration of traffic. The request shall be directed to the County and the agency in control of the right-of-way. Approval shall be considered only when received in writing.

316 Safety of Construction

Contractors shall comply with the latest Occupational Safety and Health Act requirements.

317 Clean Up and Restoration of Surfaces

All surfaces, including grass or lawn, pavement, sidewalk, curbing, and other surfaces, disturbed or destroyed during and as a result of the construction shall be replaced by the Contractor as specified herein.

317.01 Top Soil Placement and Grading:

- a) General: All topsoil will be removed during the earthwork operation and stored for later use in location(s) indicated on the Drawings.
- b) The topsoil will be hauled from the stockpiles and placed on the completed cuts or fills in accordance with the plans. The final grading will then be carried out to the elevations as shown on the Drawings.
- c) Topsoil: Topsoil shall not contain more than 40 percent clay in that portion passing a No. 10 sieve and shall contain not less than 5 percent nor more than 20 percent organic matter as determined by loss on ignition of samples dried at 212 degrees Fahrenheit to a constant weight.
- d) Fertilizer: Fertilizer shall contain the specified percentages of total nitrogen, available phosphoric acid, and water-soluble potash. The weight, name of plant nutrients, and guaranteed percentages shall be marked on the sealed fertilizer containers.
 - 1) 12-12-12: This fertilizer shall be used with Seed Mixes 1, 2, and 3.
 - 2) 5-10-10: This fertilizer shall be used with Seed Mix 4 (Crownvetch).
- e) Inoculant: Seed Mix 4 (Crownvetch) shall be treated with inoculant culture of nitrogen fixing bacteria not more than one year old.

317.02 Restoration: Unless otherwise provided, the Contractor shall perform restoration of surfaces as the Work progresses and will be directed to cease excavation and the laying of conduit until such restoration is accomplished. When surface soil is replaced, any settlement below the original ground surface occurring within the guarantee period shall be refilled with surface soil equivalent to the original material.

317.03 Seeding: The work shall be performed as required and in accordance with the following specifications, except as modified herein:

- a) Seed Mix: All areas to be seeded shall be seeded with Seed Mix 1, unless otherwise noted.

Seed Mix Table			
Seed Mix	Composition	Minimum Germination	Minimum Purity
Seed Mix 1 (use unless shown otherwise on plan)	40% Kentucky Bluegrass (Poa pratensis)	75%	85%
	40% Creeping Red Fescue (Festuca rubra)	85%	98%
	20% Annual Ryegrass (Lolium multiflorum)	85%	95%
Seed Mix 2	20% Kentucky Bluegrass (Poa pratensis)	75%	85%
	80% Annual Ryegrass (Lolium multiflorum)	85%	95%
Seed Mix 3	90% Perennial Ryegrass (Lolium perenne)	85%	95%
	10% Alsike Clover (Trifolium hybridum)	85%*	98%
Seed Mix 4 (Crownvetch)	30% Crownvetch (Coronilla varia)	70%*	99%
	30% Kentucky 31 Fescue (Festuca arundinacea var. Ky.31)	85%	95%
	30% (Pennlawn) Red Fescue (Festuca rubra)	85%	98%
	10% Annual Ryegrass (Lolium multiflorum)	85%	95%

*Germination includes a total of quick germination plus hard seeds

- b) Preparation of Seed Bed:

- 1) Topsoil: Topsoil that is available as part of the excavated material shall be removed, stockpiled, and used to backfill the areas to be seeded. All grass, weeds, rocks >1-inch in diameter, sticks, stones, and other debris are to be removed and the seed bed carefully finished by hand-raking.
- 2) Non-Topsoil: If there is a deficiency of topsoil as part of the excavated materials, the Contractor shall provide topsoil from another source at no cost to the County.
- 3) Seed Mix 1: When Seed Mix 1 is required, the seedbed shall be 4 inches of topsoil.
- 4) Seed Mix 2: When Seed Mix 2 is required, the seedbed shall be a minimum of 2 inches of topsoil.

- c) Mulch:

- 1) Straw: Straw mulch shall be baled wheat or oat straw free of weed seed, sticks or other foreign material.

- 2) Wood Cellulose Fiber: Wood cellulose fiber mulch shall be dyed green and shall not inhibit the growth or germination of the seed.
- d) Asphalt Emulsion: Emulsion shall conform to American Association of State Highway and Transportation Officials (AASHTO) M140 or AASHTO M208.
- e) Dry Seeding: When a seed mix is sown dry, the materials shall be applied as follows:
 - 1) Fertilizing: Fertilizer shall be applied uniformly to all areas to be seeded at the rate of 10 pounds per 1,000 square feet in topsoil or 20 pounds per 1,000 square feet in non-topsoil. The fertilizer shall be disked, harrowed or raked into the seedbed to a depth of 2 inches. The Contractor shall provide a smooth seedbed prior to seeding.
 - 2) Seeding: The seed shall be mixed thoroughly and sown thoroughly over the prepared areas. After sowing, the area shall be raked, dragged or otherwise treated to cover the seed with soil to a depth of ¼ inch.
 - 2.1) Seed Mixes 1, 2, and 3: These seed mixes shall be sown at a rate of 8 - 10 pounds per 1,000 square feet.
 - 2.2) Seed Mix 4 (Crownvetch): This seed mix shall be sown at a rate of 2 pounds per 1,000 square feet. Prior to sowing, it shall be inoculated in accordance with manufacturer's directions. This seed mix shall not be sown during the months of September or October.
 - 2.3) Water: The Contractor shall water the seeded areas at the completion of the sowing and weekly thereafter unless a natural rainfall of ½ inch has occurred within the same time span.
 - 2.4) Mulching: Straw mulching material shall be placed evenly over all seeded areas within 48 hours of seeding at a rate of 2 tons per acre between March 15 and October 15 and at a rate of 3 tons per acre between October 16 and March 14. Straw mulching material shall be secured with asphalt emulsion applied at a rate of 60 gallons per ton of mulch or by other approved methods. Mulching which is displaced shall be replaced and the area reseeded; other work damaged as a result of mulch displacement shall be repaired.
- f) Hydraulic Seeding: When seed is applied hydraulically, a combined slurry of fertilizer, inoculant when required, seed, and wood cellulose fiber mulch shall be applied in one operation. The inoculant for Seed Mix 4 (Crownvetch) shall be increased to 5 times the manufacturer's recommended rate for dry seeding. Wood cellulose fiber shall be mixed at a rate of 1,500 pounds per acre. Fertilizer and seed shall be mixed at the rate specified for dry seeding.
- g) Sodding: All areas requiring sod will be done in accordance with Item 660 ODOTCMS.
- h) Planting Trees and Shrubs shall be done in accordance with Item 661 ODOTCMS.
- i) General: Seeded areas shall be maintained by the Contractor. Settled and eroded areas shall be filled, graded, and reseeded as requested by the County at any time during the guarantee period. Seeding will not be accepted unless it is alive and healthy.

- 317.04 Pavement: All pavement damaged or removed during construction shall be replaced per the Standard Construction Drawings and requirements of these specifications.
- 317.05 Sidewalks: All sidewalks damaged or removed during construction shall be replaced per the Standard Construction Drawings to the width of the existing sidewalk.
- 317.06 Curbs: All curbs damages or removed during construction shall be replaced per the Standard Construction Drawings or the same as existing as directed by the County.
- 317.08 Other Surface: Any surface damaged or removed during construction shall be replaced in kind..

318 – 399 RESERVED

CHAPTER IV – SANITARY SEWER

401 Description

This section describes the work required to install sanitary sewers, including the pipe, manholes, and structures. The work includes all clearing and grubbing; removal and restoration of fences, sidewalks, pavements, and other property; trenching; bedding and backfill; construction; providing and removing all dewatering and pumping systems; all shoring, cribbing, and sheathing; testing; and any other work associated with installing complete, usable conduits, including tees, wyes, manholes, and structures. The requirements stated in this chapter are in addition to those stated in Chapters I, II, and III, whether or not a section of any chapter is specifically referenced herein.

402 Materials

The sanitary sewer line and associated materials and equipment shall be as shown on the Drawings and specified in Chapter II of these Specifications.

403 Trench Excavation

The trench shall be excavated in accordance with Section 302 of these Specifications.

404 Bedding

The bedding shall be placed in accordance with Section 304 of these Specifications.

405 Laying Conduit

Except where otherwise directed by the County, the conduit shall be laid starting at the lowest point with the bell or groove end laid upgrade. The bottom segment of the conduit shall be in contact with the shaped bedding throughout its full length. All conduit shall be laid with ends abutting and true to line and grade. Line and grade for sanitary sewer conduit shall be established by the Contractor using a laser beam or other approved method. Any method used shall provide a means to periodically check the accuracy of the method being used. Conduit shall always be installed with the pipe markings facing up in the trench before being backfilled.

- 405.01 The method of joining conduit sections shall be such that the ends are fully entered and sealed. The inner surfaces shall be reasonably flush and even, with all possible care being used when joining the conduit to ensure that the conduit ends are clean. Gaskets shall be installed in accordance with the manufacturer's recommendations. All connections with structures shall be made watertight, using an approved flexible watertight joint. Grout shall not be used to make the structure watertight. Structures not made watertight using flexible watertight joints shall be re-excavated, replaced or repaired as necessary to make watertight. All exposed surfaces shall be smooth and flush with the adjacent walls.
- 405.02 Concrete blocking, supports, and buttresses shall be provided at all tee's, bends, valves, and at any other location shown on the Drawings or as directed by the County. These concrete structures shall be Class C (ODOT CMS 2010) concrete per Section 204 and shall be built to the lines, grades, and dimensions shown on the Standard Construction Drawings.
- 405.03 During any construction where the outside temperature is below 40 degrees Fahrenheit all rubber gaskets and lubricants shall be kept in an area heated to at least 40 degrees Fahrenheit until needed. No gasket or lubricant shall be out of the heated area more than 5 minutes

before being placed in the bell or on the spigot of the pipe. The Contractor shall lubricate all joints according to the manufacturer's recommendations.

- a) Inclement Weather Conditions: All work which will be adversely affected by climatic conditions such as rain, wind, frost or temperature shall be suspended at the discretion of the County. Whenever work proceeds under such conditions, the Contractor shall provide approved facilities for protecting all the materials and the finished work. This shall include heating of materials if required for proper installation. No materials shall be installed during climatic conditions that do not meet said manufacturer's recommendation.
- 405.04 The Contractor shall furnish and install, prior to testing, all fittings, air release valves, wyes, and service taps in the number, sizes, and locations shown on the Drawings, or at locations selected by the County. All appurtenances are to be furnished and installed by the Contractor.
- 405.05 The Contractor, in connection with the laying of the sewer line, shall furnish and install all valves as shown or as directed by the County. Valves will be provided with mechanical joint ends, unless otherwise shown or approved by the County. The Contractor shall furnish and lay any special casting necessary to make the valve installation as shown on the Drawings.
- 405.06 The Contractor shall furnish and lay all closure pieces, special bends, and fittings necessary for construction of the pipe along the route shown by the Drawings.

406 Backfill / Trench Dams

All trenches and excavations shall be backfilled, and trench dams provided in accordance with Section 305 of these specifications.

407 Manholes and Special Structures

- 407.01 General Construction Methods: Construction for the item specified shall conform to the Standard Construction Drawings and be placed at the locations and elevations shown or ordered except that the height of any unit may be changed to meet finished grade.

Adequate precautions shall be taken to prevent concrete or mortar from freezing. Brick, concrete block, etc., having a temperature of 40 degrees Fahrenheit, or less shall not be set with mortar until heated for a period sufficient to insure a temperature of 50 degrees Fahrenheit to 80 degrees Fahrenheit, throughout the entire mass of the material.

Iron frames, taps, and covers shall be of the type and set as called for on the Drawings or Standard Construction Drawings. Special care shall be exercised to prevent the entrance of earth or debris into the pipelines connecting with the manhole or special structure. All such earth or debris resulting from the construction operations shall be removed.

- 407.02 Manholes: Manholes shall be pre-cast, meeting ASTM C478. The joints between sections shall conform to ASTM C443. The pre-cast bottoms and sections shall be provided with lifting lugs and reinforced for handling. Manhole sections shall be assembled with Con Seal at all section joints or an external EPDM Sealing system per Sealing Systems, Inc. or approved equal, in addition to the sealed O-ring joint. Bottoms shall be set so as to have a uniform bearing on at least 6 inches of granular material as shown on Table No. 703.01-1, No. 57 aggregate, (ODOT CMS). The invert channel shall be the true shape of the lower half

of the sewer conduit. The sewer shall be connected to the manhole with a flexible watertight joint of approved manufacture using a rubber sleeve with stainless steel banding or a rubber gasket that seals through compression or expansion, conforming to ASTM C925. The annular space between the outside wall of the pipe and the wall opening of the manhole shall be filled to the springline of the pipe with trowelable Easy Stick or approved equal. Grout on the interior of the manhole is not permitted to make the manhole structure watertight. Materials and installation shall be in accordance with the Standard Construction Drawings.

- 407.03 Special Structures: Concrete structures shall be precast unless approved by the County.
- 407.04 Excavation: The excavation shall be such that ample room for construction is provided and shall include the removal of any obstruction which is necessary to provide ample room.
- 407.05 Backfill: The backfilling shall follow the completion of the work as closely as the type of construction will permit. The backfill material for all manholes and structures shall be Type A material to an elevation a minimum of 12 inches above the top of the pipe, unless otherwise shown on the Drawings.
- 407.06 Manhole Casting, Cover, and Grade Ring: Refer to Section 208 for specifications.

408 Forcemain Testing

A hydrostatic test as required in applicable sections of AWWA C600 shall be applied to the whole or to individually isolated sections of the force main either before or after the trench is backfilled. The pressure during the test shall be maintained at 1½ times the working pressure, but not less than 50 psi at the highest elevation and not exceeding the maximum pressure rating of the pipe, whichever is greater, in any section being tested. The duration of each pressure test shall be at least 2 hours. The Contractor shall supply, and the RPR shall verify, gauges for the test. Furthermore, the Contractor shall furnish all materials, make all taps required, and furnish a pump, piping, all other equipment and all assistance necessary for conducting the tests. Before applying the specified pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made by the Contractor at points of highest elevation or as required. Taps shall be of the sizes as shown on the Drawings or as directed by the County.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. No pipe installation will be accepted until this leakage (evaluated on a pressure basis of 150 psi) is less than 1.99 U.S. gallons per hour per 100 joints of 12 inch nominal diameter pipe and correspondingly varied for other sizes of pipe as provided in the AWWA Specifications.

Any testing performed against existing valves shall be at the Contractor's risk and in strict compliance with the requirements of the County. If unable to achieve the required test the Contractor shall disconnect from the existing valve, plug the line, make necessary repairs, and retest until satisfactory results are obtained. Any damage caused to existing facilities shall be repaired at the Contractor's expense.

409 Sewer Testing

The Contractor shall furnish all labor, equipment, and materials which are required to test the sections of the sanitary sewer conduit and manholes for watertightness. The Contractor shall perform the air/vacuum test. All tests shall be conducted in the presence of the RPR. The tests for leakage shall include all portions of the sanitary sewer system, including manholes and service lines, that are installed

by the Contractor. The sewer shall be tested in sections, each section extending between 2 consecutive manholes or from the end of the sewer to the nearest manhole. No test shall be performed until the sewer line has been backfilled for at least 30 days.

409.01 Air Test: The inlet end of the upstream and downstream manhole shall be closed with an airtight bulkhead. The sewer will then be put under pressure to 3.5 psig. The minimum time requirements for the 0.5 psig pressure drop from 3.5 psig to 3.0 psig shall not be less than the following:

Pipe Size (Inches)	Time
4	1 min 53 sec
6	2 min 51 sec
8	5 min 04 sec
10	7 min 54 sec
12	11 min 24 sec
15	17 min 48 sec
18	25 min 38 sec
21	34 min 54 sec
24	45 min 35 sec
27	57 min 42 sec

An air pressure correction is required when the prevailing ground water is above the sewer line being tested. Under this condition, the air test pressure must be increased 0.5 psi for each foot the ground water level is above the invert of the pipe.

409.02 Vacuum Test: All manholes shall be vacuum tested in accordance with the following specifications. The test head shall be placed at the top of the manhole casting and the manhole vacuum tested after the internal or external seal has been installed. A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop one inch. Manholes should be tested prior to backfilling and not submerged in ground water. Ground water pressure if present should be taken into account and care should be taken not to over pressurize manhole gaskets.

The manhole shall pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in the following table:

Minimum Test Times for Various Manhole Diameters									
Depth (Feet)	Diameter (Inches)								
	30	33	36	42	48	54	60	66	72
Time (Seconds)									
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	34	41	46	51	57
16	22	24	28	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	58	65	72	81
22	31	33	38	46	55	64	72	79	89
24	33	36	42	51	59	70	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

If the manhole fails the initial test, necessary repairs shall be made by using an injectable grout approved by the County. The manhole shall then be retested until a satisfactory test is obtained.

- 409.03 Deflection Test: When PVC pipe is used, a deflection test shall be made by pulling through the sewer a rigid ball or mandril having a diameter equal to 95 percent of the inside diameter of the pipe. The mandril shall have an odd number of runners, with 7 as the minimum number. This test shall be run no sooner than 30 days after the sewer is backfilled. The test shall be performed under the direction of a licensed Professional Engineer as required by the Ohio EPA. The RPR must be on site during the deflection test. The test shall be repeated one month prior to expiration of the Maintenance Guarantee period.

410 Service Wyes

- 410.01 Sanitary service wyes shall be designed outside of the project pavement surface limits.
- 410.02 The Contractor shall furnish and place, as directed, approved wye poles made of 4" X 4" hardwood lumber at all wye locations, ends of extended services or at the end of each riser where risers are required. The wye poles shall extend above the ground at least 3 feet and have a minimum bury of 4 feet. Wye poles shall then be painted green. In addition, the Contractor shall anchor a section of rebar, 18 inches in length, to the wye pole for detection. The rebar shall be installed vertically in such a manner so as to provide 6 inches of cover over the top.

411 Risers

Risers, if called for on the Drawings, shall be placed at the mainline sewer to the lengths specified.

412 Service Connections and Lines

- 412.01 Service or house connections shall be installed in accordance the Muskingum County Sewer Department, Sewer Rules, Appendix G, Sewer Connection Manual. This information is

available on the Internet at
<https://www.muskingumcountyoh.gov/Media/Appendix%20G%20Connection%20Manual%2012-16-19.pdf>

413 Storm Water Connections

No downspouts, surface inlets, foundation drains or any other source of ground or surface water shall be connected either directly or indirectly to or discharged into any part of the sanitary sewer system.

414 Valves

Valves 2 inches and larger shall conform to Section 212.

- 414.01 Extension Stems: If the top of the operating nut is more than 36 inches below the finished grade an extension stem shall be provided to place the operating wrench nut between 24 inches and 36 inches of the finished grade. Cost of extension items shall be included in the unit price bid for the various valve types and sizes.
- 414.02 Valve Boxes: Unless otherwise noted on the Drawings or directed by the County, all valves 2 inches and larger shall be provided with Standard Valve Boxes. Covers for the boxes shall be marked "SEWER". All boxes shall be provided with the necessary extensions to bring the top of the box to the finished grade. All valve boxes shall be installed such that they are centered vertically over the valve operating nut and such that the box provides maximum cover of the operating housing. Boxes that are to be installed in areas subject to vehicular travel shall be the Traffic Type Valve Boxes. All valve boxes shall be as shown on the Standard Construction Drawings.
- 414.03 Valve Supports: Concrete piers or supports shall be provided under all valves per Section 405.02.
- 414.04 Operation: All valves which affect the flow of sewage through active lines are to be operated by County personnel only.

415 Tools and Spare Parts

Each project which installs public or communal sanitary sewers shall provide one set of the following items plus one additional set for every 10 manholes installed on the main line sewers.

Additional Parts and Tools	
Item*	Quantity
Complete Wrapidseal External Chimney Seal	1
Inflow Protection Dish with Gasket	1
Manhole Lifting Hook	1
Complete Manhole Casting	1

* Items shall be delivered to a location specified by the County

416 Sewage Pump Station Requirements

- 416.01 General: The Contractor shall, unless otherwise notified, furnish all labor, materials, equipment, tools, and incidentals necessary to install, test, complete and make ready for operation a submersible sewage pump station. This includes the furnishing and installation of all necessary and desirable accessory equipment and appurtenances, whether specifically mentioned in these specifications or not, as required for a successful installation.

The Contractor shall be responsible for all excavation and removal of obstructions and restoration of all properties involved directly with the construction and installation of the pump station.

- 416.07 Tools and Spare Parts: All special tools and recommended spare parts required for normal operation and maintenance shall be supplied for each piece of equipment furnished.

The following spare parts shall be furnished as a minimum:

- a) One (1) set of 1 upper and 1 lower mechanical seals and a seal tool.
- b) One (1) set of gaskets, O-rings, grommets, and other sealing devices.
- c) One (1) rotating wear ring (if so equipped) or a spare impeller, and one (1) stationary wear ring (if so equipped) or spare volute.
- d) One (1) complete set of spare fuses for all electrical devices.
- e) Five (5) spare bulbs for each incandescent lamp type or 2 spare bulbs for each LED fixture, if LED bulbs are used.
- f) One (1) control relay of each types used.
- g) One (1) spare pump when five (5) hp or below. If item g) is provided then items a), b), and c) can be waived.

All spare parts shall be delivered to the owner prior to final completion and start of the warranty period.

- 416.08 Operation and Maintenance Manuals: Four (4) complete sets of installation, operation and maintenance instructions shall be provided for all equipment and electrical components. The manuals shall be prepared specifically for the installation to which they pertain and shall include all available installation manuals, operation manuals, maintenance manuals, catalog cuts, drawings, wiring diagrams, equipment and parts list, list of spare parts provided, warranties, product descriptions, etc. All four (4) sets of manuals for major equipment shall be original manufacturer's manuals-copies will not be acceptable. Only one (1) set of original manufacturer's literature is required for miscellaneous components; copies of this literature are required for miscellaneous components; copies of this literature will be acceptable for the other three (3) O & M manuals. Copies must also be provided on a USB Flash Drive in PDF format.

- 416.09 Record Drawings: The Record Drawings shall consist of the Contract Drawings revised per-as-built conditions and the approved Shop Drawings. As-built revisions to the Drawings shall be professionally drafted. The Record Drawings shall be submitted to the County and on a USB Flash Drive in AutoCAD and PDF format upon completion of the construction. The Record Drawings must consist of four (4) bond copies; two (2) being of 24" x 36" size and two (2) being of 12" x 18" size.

Contract Drawings shall be legibly marked in the field to record the actual construction procedures and installation methodology including:

- a) All deviations in location or elevation of any underground installation from that shown on the Contract Drawings.
- b) Any significant changes in above-ground installation from the approved Shop Drawings or Contract Drawings.
- c) Indication of County's approval of any such deviations or changes from the Contract Drawings or approved Shop Drawings.

416.10 Submersible Pump Requirements: Pumps shall be Barnes Chopper Pumps (Sithe) or approved equal. Pumps shall be 460/480 Volt (V), 3-phase, and 60 hertz (Hz). All pumps shall be operated on VFD and be provided with an inverter duty motor in accordance with NEMA MG1, Part 31. A service factor of 1.0 will be acceptable when driven by a variable frequency drive (VFD). Grinder pumps are only allowed for special circumstances as approved by the County.

The pump shall be capable of 65 feet of continuous submergence without loss of watertight integrity. Pump and motor shall be made by the pump manufacturer. Pumps shall be provided with tungsten carbide seals on both upper and lower faces. Pump motor shall be housed in an air filled, water-tight casing, and shall have Class F or better non-hygroscopic insulated windings which shall be moisture resistant. Motors shall be NEMA Design B, equipped with a 1.15 service factor, as defined in the NEMA MG1 standard, based upon the nameplate horsepower rating for across-the-line service. Pump motors, cables and appurtenances shall be rated for operation in a Class I Division 1, Group D hazardous environment.

A 316 stainless steel nameplate shall be attached to the top of each pump and in the control panel. The manufacturer's name, rated capacity, total head, model number, serial number, and all other pertinent data shall be stated. A 316 stainless steel lifting chain with a minimum of three (3) interspersed lifting rings shall be provided. The chain shall be of sufficient strength to raise and lower the pump with a safety factor of two (2) and a minimum of ¼ inch thick chain links.

The pump shall be supplied with a mating cast iron discharge connection elbow. The elbow shall be permanently connected to the wet well along with the discharge piping and the pump slide rails. The slide rails shall be stainless steel and have a minimum diameter of two (2) inches and be sized in accordance with the manufacturer's recommendations. The pump shall be easily removable and replaceable via the slide rails and quick disconnect system. No entry into the wet well shall be required to remove the pumps.

The interior piping shall be Ductile Iron Pipe, Class 53 with flanged joints conforming to AWWA C 115 and fittings conforming to AWWA C 110 unless internal pressures require a higher rated material. Pipe and fitting coating and lining shall be an asphaltic coating with a minimum 1 mil thickness.

The pump shall be provided with a cable entry design that shall preclude specific torque requirements to ensure a watertight and submersible seal. The cable entry shall be certified by UL or FM to have passed pull-testing requirements. The cable entry junction chamber and motor shall be separated by a stator lead, sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access to the pump motor top. The cable entry system shall be field serviceable. The power and control cable entry into the lead connection chamber may also be epoxy encapsulated for positive moisture sealing. A BUNA-N cable grommet shall be provided in addition to the epoxy sealed leads.

The pumps shall be supplied with power and sensor conductors. Pump motor cables shall be sized to meet applicable NEC requirements. The cable shall consist of a type SEOW insulated cable with a double jacketed protection system. The cable shall have a neoprene or chlorinated polyethylene outside and synthetic rubber inside, and shall exceed industry standards for oil, gas and sewage resistance. Individual conductors shall be of type RUW. Pump cables shall be provided of sufficient length so that the cables will be continuous between the pump and the disconnect with no splices being allowed.

Pump shall be supplied with moisture and temperature motor protection relays. Motor protection relay shall be provided by the pump manufacturer and mounted within the Pump Station Control Panel.

Each pump/motor unit(s) shall be equipped with the following protection and monitoring sensors:

- a) Three motor winding bi-metallic thermal switches or thermistors, one installed in each motor stator phase winding, and connected in series to monitor and protect the winding from over temperature operation. The thermal switches shall open, activating an alarm and stopping the motor should a high temperature event occur.
- b) One Float-type Moisture (Leakage) Sensor (Stator FLS) shall be provided to detect water intrusion into the motor stator chamber. If activated, the FLS will activate an alarm.

416.11 Shop Drawing and Pump Curve: Shop drawings shall be submitted as required by Item 106 of these Specifications. They shall consist of complete dimension drawings including location of pumps, piping, hatches, valves, and other accessories. A factory certified pump curve shall be submitted for review on all pumps greater than 10hp and shall include capacity, power requirements and efficiency at a minimum of five (5) points on the curve.

416.12 Pump Station Access: Access is provided as shown on the Drawings.

416.13 Mounting Hardware: All mounting hardware shall be 316 stainless steel. All brackets, supports, hangers, and braces inside the wet well shall be stainless steel. All power and control wires inside of wet well shall be attached to wet well with stainless steel pulling grips.

416.14 Structures: The wet well or valve vault 10 feet diameter and smaller shall be constructed of manhole sections in accordance ASTM C 478 with watertight rubber gasketed joints per ASTM C 443. Structure joints shall also be provided with a field applied mastic seal equal to Conseal CS-202. The base section shall consist of a riser section with a 12-inch-thick integral floor and six (6) inch anti flotation "Lip" around the exterior. The top shall be flat and be precast concrete with a minimum twelve (12) inch thickness. The requirements for wet wells larger than ten (10) feet in diameter shall be constructed as shown on the Drawings.

Each structure (wet well or valve vault) shall have an access cover. Access covers shall be aluminum with 316 stainless steel hardware and flush mounted. The covers shall be rated for three hundred (300) pounds per square foot loading. The finish shall be checkered, diamond plate or other approved non-slip surface. The valve vault shall have a minimum dimension of 36" x 48". The wet well shall have a rectangular hatch opening which provides the maximum size opening. At a minimum, the wet well hatch shall provide a twelve (12) inch clearance from the back of the pump volute (away from the slide rails) to the edge of the opening to facilitate easy removal. The wet well and valve vault hatches shall be Halliday,

Bilco or approved equal. Wet well shall be equipped with davit crane stand as approved by the County. The interior of the wet well shall be coated with Spectrashield, OBIC Armor 1000, or an approved equal.

Pump Station and Valve Vault shall be provided with manhole steps in accordance with Drawings.

A grout fillet shall be properly designed and constructed around the full circumference of the station of the wet well's bottom to direct grit and other solids to the pumps.

Each Valve Vault shall be fitted with a drain line back to the wet well. The drain line shall have a minimum diameter of two (2) inches, be of schedule 80 PVC, be placed at a 2% slope or better, and have a trap and check valve. The check valve shall be exposed in the wet well and be attached with a NPT threaded joint to permit changing the valve. The pipe shall extend a minimum of twelve (12) inches into the wet well but shall not interfere with the operations of the station or removal of the pumps.

- 416.15 Valve Vault: A valve vault shall house the valves, check valves, and bypass pumping connection for the pump station. Each pump shall have a swing check valve and gate valve. The bypass line shall be of the same diameter of the submersible pump discharge line and have a Bauer Style Type B "Male" by 150lb flange fitting with a Bauer Style Type B "Female" plug, or approved equal. The bypass line shall also have a check valve, gate valve, and two (2) inch drain line with shutoff valve back into the valve vault. The maximum depth of the valve vault is seven (7) feet. A stainless steel pressure gauge shall be located on the upstream side of each swing check valve. The pressure gauge shall be Ashcraft, Amtek, or approved equal, with an acceptable pressure range. A magnetic flow meter shall be installed in accordance with 417.12.
- 416.16 Connections: All pipe wall connections shall utilize Kor-N-Seal Press Wedge manhole boots per the Drawings, or approved equal. Once the wet well and valve vault are tested and approved, angular space shall be filled with non-shrink grout.
- 416.17 Vent: The wet well shall be provided with a four (4) inch Green Cap Vent or approved equal. The pipe shall be made of epoxy-coated ductile iron, stainless steel or other corrosion resistant material. PVC and black iron are not acceptable.
- 416.18 Testing: The wet well and valve vault shall be tested prior to backfilling as follows: The vaults shall be filled with water for twenty-four (24) hours and any visible leaks repaired immediately. If the water level drops more than twelve (12) inches within twenty-four (24) hours, the structure fails the test and the contractor shall make the necessary repairs to pass the test.
- 416.19 Bedding and Backfill: The wet well and valve vaults shall be bedded and backfilled in accordance with the pump station standard drawing and Section 407 Manholes and Special Structures.
- 416.20 Gate Valves: Gate valves shall be in accordance with Section 212.
- 416.21 Swing Check Valves: Check valves shall have exterior weighted arms and conform the AWWA C 508. Valves shall be cast iron body with a bronze mounted, single-disc, 175 psi working pressure, cushioned closing type. Valve shall be coated in accordance with AWWA

C-550. Check valves shall be air cushioned, horizontal swing bolted bonnet, removable seat and disc flanged from G.A. Industries or approved equal.

- 416.22 Surge Relief Valves: Force Mains with a total dynamic head greater than 80 feet shall be required to have a surge Relief Valve. The valve shall be installed in the valve vault and discharge into the wet well. The valve shall be an APCO Angle-Style Surge Relief Valve or approved equal.
- 416.23 Fence: Each pump station shall be provided with a six (6) foot, galvanized 1-inch fabric, chain link fence with three (3) strands of barbwire and galvanized metal fence posts conforming to ODOT CMS Item 607. The fence shall provide at least ten (10) feet of working radius from each structure. Both a twelve (12) foot wide vehicle gate and four (4) wide personnel access gate of like material shall be provided. The layout of the fence and gate are as shown on the Drawings. A warning sign shall be mounted on the fence which identifies that in case of an emergency, please contact (740) 452-4940.
- 416.24 Driveway: Each pump station shall be provided with driveway. The driveway shall be minimum twelve (12) feet wide and run to the wet well. The drive shall consist of six (6) inches of #2 Stone installed on bidirectional geo-grid Tensar BX1200 or equal, six (6) inches of compacted ODOT CMS Item 304, and four (4) inches of No 57 aggregate.
- 416.25 Abandonment of Existing Pump Stations: Contractor shall be responsible for demolition of station and removal of all equipment as required by the Contract. All pumping equipment, controls piping and other miscellaneous equipment shall be delivered to a location designated by the County.

417 Pump Station Electrical Requirements

- 417.01 Electrical: All electrical components shall meet National Electrical Manufacturers Association (NEMA) standards, and shall comply with National Electrical Code (NEC) and Underwriters Laboratories (UL) as applicable to construction and installation of wiring and components. The electrical system inside the wet well shall comply with the NEC Article 500 for Hazardous Locations, Class I, Division 1, Group D, and the valve vault shall comply with NEC Article 500 for Hazardous Locations, Class I, Division 2, Group D. The extent of the hazardous (classified) locations shall be as defined in National Fire Protection Association (NFPA) 820 – “Standard for Fire Protection in Wastewater Treatment and Collection Facilities”. Explosion-proof conduit sealing and drain fittings shall be installed in all hazardous (classified) areas designated Class 1, Division 1, and Class 1, Division 2

A NEMA 4X enclosure shall be provided to house all electrical equipment outlined in the following specifications. The enclosure shall be mounted on stainless steel unistruts on the wet well outside the hazardous (classified) areas, in a location practical for future operation of the station. The mounting shall be completed in a manner that provides the necessary strength to adequately support the panel.

The enclosure and the electrical equipment which shall be supplied with each sewage pumping station are described in this section.

The utility company electric meter, utility company CT enclosure, service entrance-rated main breaker or fusible disconnect, and automatic transfer switch enclosure shall be mounted on a structure of three (3) inch stainless steel strut (square tubing and U-channel) to one (1) side of the main motor control panel enclosure. The control transformer shall be mounted

either on the stainless-steel strut or on the side or back of the main control panel enclosure. Where the utility company mounting requirements differ from the requirements herein, the utility company requirements shall govern for those items under their jurisdiction only.

417.02 Enclosures: Enclosures supplied with each station shall be free-standing, double-door Hoffman Catalog No. A74H7224SSLP3PT or equal (or appropriately sized equivalent) and shall be rated NEMA Type 4X. The enclosure shall be large enough to provide an unused space equal to at least thirty percent (30%) of the space required. This space shall be reserved for installation of future equipment by the County, and no wiring or controls shall intrude into this reserved space. The construction shall be equal to or better quality than 12-gauge 304 stainless steel, in accordance with ASTM A-167, and shall be supplied with a drip shield, 3-point latches, pad-lockable handles, a continuous piano-type hinge on the panel, and smooth seamless sides. All bolts, screws, pins, and other fasteners used on the enclosure shall be stainless steel.

The enclosure shall include add-on kits equal to the Hoffman Kits listed by catalog number below:

- a) Catalog No. ADSTOPK – Door Stop Kit.
- b) Catalog No. LEDA1S35 – LED light with remote switch and connection cables (provide two (2) lights if enclosure size or configuration dictates)
- c) Catalog No. DAH20001A – Design-air Electric Heater, 115 volt, with built-in thermostat, or other Hoffman Model sized properly to ensure proper air transfer and heating of entire enclosure (provide 20 degrees Fahrenheit temperature rise above ambient). Two (2) heaters will be necessary where the enclosure is divided into separate compartments.

Each enclosure shall have a door-in-door arrangement with interior swing-out panels on each side. The alternating on-off switch, circuit breakers, control switches, pilot lights, etc., shall be accessible to the operator from the inner panel without opening the inner doors. The outer panel shall be void of control devices.

The outer panel doors of the enclosure shall be secured as follows: Both the right-hand and left-hand doors shall be secured with pad-lockable Hoffman latch, Cat. # A-L1CR, or approved equal.

The sub panel in the back of the main enclosure shall be steel painted with white ceramic paint (Hoffman A72P72 or approved equal). All other components of the enclosure shall be stainless steel.

Each sewage pumping station enclosure shall be provided with one (1) duplex service outlet of 120-volt Ac 20-amp rating. This outlet shall be supplied from the control transformer. The outlet shall be located in the motor control panel behind the inner door. This outlet and any other outlets feeding instrumentation should not be feed from arc-fault protected circuit as such protection may negatively impact instrumentation operations.

All enclosures, panels, etc., (including the motor control panel) shall be UL-listed and shall be fabricated by a UL-approved shop in accordance with the NFPA 79 Electrical Standards for Industrial Machinery.

A shop drawing of the control panel shall be provided, showing panel elevation, dimensions, and weight. Interconnecting wiring diagrams shall be provided, which show all electrical connections between field-installed equipment and the control panel. Schematic control

wiring diagrams shall be provided, showing all control components, switches, pilot lights, relays, etc. The wiring diagrams shall indicate wire and terminal numbers. Each component shall be uniquely labeled. A copy of all as-built electrical/control/instrumentation drawings shall be laminated (or otherwise sealed in plastic) and permanently located in the main control panel enclosure.

A minimum 24"x24"x8" stainless steel NEMA 4X junction box shall be mounted over the wet well on two (2) vented stainless steel feed-through wireways (Hoffman F66W24SS or equal) over two (2) five (5) inch holes through the wet well top slab. The door of this junction box shall open in a direction away from any access hatches in the wet well, and the door shall be pad lockable. All wires entering the wet well (pump power and control wires, pressure transducer, etc.) shall be connected to terminal strips inside this junction box with corresponding wires extending to the main control panel. Terminals shall be labeled as "Pump 1," "Pump 2," etc. Cord grip connectors or other appropriate components shall be glued at the bottom of this junction box for all wires entering the wet well to seal the opening and provide strain relief for the wires. Stainless steel braided wire sleeved with attachment tails shall also be provided for large pump cords.

- 417.03 Circuit Breakers: All circuit breakers shall be of the thermal magnetic type, with molded case breakers. Breakers shall be UL-listed and CSA certified, and shall meet Federal Specification W-C-375B/GEN.

Three-pole breakers shall be manufactured by Square D or approved equal, and shall have a short circuit rating equal to 125% OF THE AVAILABLE FAULT CURRENT. Regardless of the available fault rating, circuit breakers shall not be less than PowerPact B-Frame for applications under 100 amps, or PowerPact J-Frame for applications between 100 and 250 amps.

Single-pole breakers shall be Square D QOU series or approved equal, and shall be used for control circuitry and peripheral devices.

A main circuit breaker shall be provided inside the main enclosure for the control panel with separate circuit breakers for each motor and transformer primary, as well as single-pole circuit breakers for control circuitry, RTU, lighting, outlets, flow meter, generator block heater, generator battery charger, etc.

Another service entrance circuit breaker or fusible disconnect shall be provided in a NEMA 4X stainless steel enclosure outside the main enclosure on the line side of the automatic transfer switch, lightning arrester, etc.

Circuit breakers shall be accessible to the operator through the inner panel door without having to come in contact with the open wiring. The main and motor branch circuit breakers shall be lockable.

A minimum of two (2) spare 120-volt AC, 15 amp circuit breakers shall be provided and mounted on the panel.

- 417.04 Magnetic Motor Starters (Pumps 3 HP or Less): Shall be equipped with three (3) poles and shall be provided with auxiliary contacts for use in the control circuit and for status inputs to the SCADA system. Starters shall be Allen Bradley Bulletin 509 type with EE E1 Plus adjustable overload relay, or Square D Class 8536 Full voltage NEMA starters with optional

solid state motor logic overload relay (Class 9065 if ordered separately). No other starters will be considered equal or allowed. All starter coils must be 110 volt.

Starters shall conform to all NEMA ratings. The minimum size starter shall be NEMA 1.

Starters shall have at least one (1) set of auxiliary dry N.O. contacts rated at 10 amps for future SCADA use.

Provisions for sequential pump starting shall be made in the controls to prevent more than one (1) pump from starting simultaneously.

- 417.05 Variable Frequency Drives (Pumps Greater Than 3 HP): The VFD shall be sized for 150% of the motor full load amps plus the service factor. The VFD shall be in an NEMA 1 enclosure and UL 508 listed. Provide VFD inverter technology and required filters to meet IEEE 519 harmonic distortion requirements and pump motor protection requirements. The VFD's shall be Yaskawa Drives, or approved equal.
- 417.06 Programmable Logic Controller (PLC): Provide a Programmable Logic Controller with the required memory and functional capacity to perform the specified sequence of operation with the scheduled input and output points (I/O). Processor systems shall include integral processor, power supply, input/output modules, communication modules, and remote interface modules as required to meet system requirements. The PLC shall communicate between the operator workstation and field mounted transducers, switches, controllers, and process actuators. Communications protocol shall be completely transparent to process operators at the Human Machine Interface (HMI). The PLC shall be capable of stand-alone operation in the event of failure of the communication link to the HMI subsystem. The PLC shall include at least 20 percent (minimum of two) I/O points of each type (AI, AO, DI, and DO) for future use regardless of whether any of those point types are used in the panel or not. Regardless of the spare requirements, all installed unused points shall be wired to terminal blocks in the order that they occur on the I/O modules. The PLC shall be Micro-Comm, Inc.
- 417.07 Operator Interface Terminal (OIT): Provide a OIT at the control panel. The OIT display size shall be minimum of 7.0" and have a backlit LED color TFT LCD display. The display shall support touch screen input. The OIT software shall be able to provide trending, data logging, alarms, graphic symbols, and animations. The manufacturer shall be Micro Comm.
- 417.08 Control Transformers: Control transformers shall be dry type, stainless steel enclosed (NEMA 3R), mounted external to the main control panel. Secondary voltage shall be 120 volt AC.
- The transformer should be sized for the proposed power requirements of the pumping station plus an additional 25% capacity for future loads, with a minimum output current rating of 30 amps. The transformer shall be protected by circuit breakers on the primary and secondary sides.
- 417.09 Control Relays & Pump Controller: All control relays shall be of the illuminated 8- or 11-pin octal plug-type, Allen Bradley, Square D or approval equal. Relays may be either direct panel-mounted or DIN rail-mounted. Control relays shall be of at least DPDT configuration.
- The submersible transducer shall control pump on and off functions via the compact programmable logic controller (PLC).

417.10 Duplex Pump Alternation: The compact programmable logic controller (PLC) shall control all pump alternating functions.

For maintenance purposes, the pump station shall be capable of being set on pump one (1) or two (2) only and have that be the lead pump for the duration of time the second pump is out of service.

The above describes a duplex alternator. Pumping stations with three (3) or more pumps shall have an alternator capable of equalizing operating hours among the pumps.

417.11 Phase Conversion: If phase conversion is required due to power constraints, a variable frequency drive shall be utilized. Drive shall be Yaskawa Drives, or approved equal. No add- a-phase units will be allowed.

417.12 Magnetic Flow Meter: A mag meter shall be provided on the discharge force main. The meter shall be mounted in the valve vault or a separate vault at the discretion of the contractor. Separate vault shall have aluminum hatch and drain line if provided. The meter shall be rated for continual submergence, have a digital display in the control panel and have a connection to the SCADA System. Manufacturers shall be Toshiba, Badger, or approved equal.

417.13 Wet Well Electronic Pressure Transducer: Transducer shall be Micro-Comm or approved equal. Watertight flexible fifty (50) foot cord to junction box.

There shall be a minimum of one (1) pressure transducer supplied with each station. The pressure transducer shall be used as follows:

- a) Low-Level Alarm
- b) Pumps off
- c) Lead pump on
- d) Lag pump on
- e) High-Level Alarm

The station shall have a four-float backup system:

- a) Pumps off
- b) Lead pump on
- c) Lag pump on
- d) High-Level Alarm

The High-Level Alarm shall be wired to the local alarm and SCADA alarm. All items shall be integrated with the SCADA system.

Cable hanger(s) shall be located at the edge of the pump hatch opening, unless otherwise shown on the Drawings or directed by the County.

417.14 Switches and Pilot Lamps: All lamps shall be of the LED type.

Switches and pilot lamps shall be oil-tight and shall meet NEMA standards for A600 heavy duty contacts. Each pump shall have a separate selector switch with the following settings: HAND-OFF-AUTO (HOA). Each pump shall also have a green LED pilot lamp connected to auxiliary contacts on the starter to indicate when the pump is running and a red LED pilot lamp to indicate when the pump is stopped. A yellow LED pilot lamp shall be provided for

each pump connected to auxiliary contacts to indicate when the pump is in a fault condition. These switches and lights should be located inside the control panel.

All HOA switches and pilot lamps shall be Allen-Bradley, Schneider Electric, or approved equal. Switches and pilot lamps shall be oil-tight and shall meet NEMA standards for A600 heavy-duty contacts. All pilot lamps shall have the push-to-test feature.

- 417.15 Voltage Monitors: A voltage monitor shall be supplied to monitor the incoming voltage. This unit shall be manufactured by Schneider Electric or approved equal. The monitor shall be rated at either 480 volt AC or 240 volt AC, according to the incoming voltage source. The restart delay shall be adjustable from 0.25 to 64 seconds. Voltage monitor shall monitor all incoming phases. Protection of the voltage monitor, on the incoming voltage, shall be through 2-amp fast-blow fuses (Bussman KTK-R2 or equal). Voltage and current monitoring shall be provided for all legs (L₁, L₂, L₃).

When an under-voltage condition occurs, an alarm shall be sent via the SCADA system after an adjustable time delay.

- 417.16 Wire and Cable: All wiring and cable installation shall conform to NEC regulations and shall comply with local codes. All conductors shall be copper. Wiring shall not be operated above 75 degrees Celsius.

For electrical equipment feeders (motor control center, motor branch circuits, etc.), located below grade or for exterior control and motor circuits, wiring shall be type THHN/THWN through #2 AWG and type RHH for larger than #2 AWG.

For branch circuits for lighting and receptacles, wiring shall be type THHN/THWN in conduit. For branch circuits for interior, wiring shall be type THHN/THWN.

Power wiring shall be #12 AWG minimum, and control wiring shall be #14 AWG minimum.

For instrumentation (i.e. 4-20 mA signals), cables shall be 16 AWG copper, NEC-type TC rated at 600 volts (Belden No. 1118A or equal) individually shielded twisted pair cable. All digital signal wires may be of the type of wire specified above.

All SCADA and signal wires shall be in conduit separate from any AC power lines. All motor circuits must be in separate conduits from any lighting, receptacle, or control wiring.

All conductors shall be sized such that voltage drop does not exceed three percent (3%) for branch circuits or five percent (5%) for feeder branch circuit combinations.

The use of pulling compound shall be required in all installation of wire pulled in conduit as needed. All conduits shall be sized in accordance with NEC regulations and/or local codes.

All terminal blocks shall be Allen Bradley Terminals Model # 1492-CA1 for wire sizes #22 - #8 with mounting channel Model #1492-N1, end barriers Model # 1492-EBL10, and end anchors Model #1492-N23, or approved equal. At least ten percent (10%) spare terminals shall be provided on all terminal strips. Bare wire ends shall be connected into the recessed terminals. No-fork-tongue compression terminals shall be used unless approved by the Engineer for specific applications. A UL-listed anti-oxidation compound shall be used on any wires connected with wire nuts. All ground connections shall have one (1) wire per lug.

All wiring and components shall be tag-numbered and clearly marked at each termination in accordance with the Drawings and as directed by the County. Wire tags shall be heat shrink

type wire markers with permanent legible machine printed markings and numbers. Adhesive or taped-on tags are not acceptable.

417.17 Raceways and Conduit: All conduits shall be of one (1) of the following types:

- a) Rigid aluminum conduit, which shall comply with NEC and local codes. Rigid aluminum conduit shall be used for all above-grade installations and shall not be used for buried conduits.
- b) PVC plastic, which shall be Schedule 80. All PVC conduits shall comply with NEC and local codes and have glued joints. PVC conduit shall be used for interior conduits and be used for all buried conduits.
- c) Liquid-tight, which shall be flexible steel conduit with a high tensile strength galvanized steel core and continuous copper ground built into the core. This conduit shall have a smooth non-wrinkling PVC jacket that will not pull away from fittings. This conduit shall be type LA Liguatite as manufactured by Electri-flex, or approved equal. Liquid-tight conduit shall be used for any final runs into instrumentation equipment, and shall not exceed 18 inches in length.

Conduits between the wet well and control panel shall have a minimum size of 2", shall be sealed gas-tight, and shall be as follows, unless otherwise approved by the County:

- 1 conduit for each pump
- 1 conduit for level transducer
- 1 conduit for future (spare)
- 1 conduit for float wires

All conduits shall be tagged and identified with brass tags held on by copper wire at both ends.

Conduit routing and wire pulling schedules shall be submitted with shop drawings.

Conduits for three phase wire between the main transformer and the automatic transfer switch, as well as between the generator and the automatic transfer switch, shall be encased in a minimum of three (3) inches of concrete on all sides. Other conduits shall be encased in concrete when shown on the plans. Other buried conduits may be encased at the discretion of the Contractor. Concrete encasement shall be colored as required by electrical codes.

Plastic conduit spacers shall be used for all buried conduits, whether encased in concrete or not.

417.18 Grounding: All submitted wire plans shall show a grounding scheme. Grounding shall comply with NEC requirements. Grounding shall be designed by a qualified designer and tested upon installation.

417.19 Nameplates: Engraved nameplates shall be provided for every circuit breaker, control switch, pilot, etc. Nameplates shall be white-faced tags with engraved black letters. Letters shall be at least 3/16-inch in height.

Nameplates shall be attached to the panel by means of stainless steel machine screws.

- 417.20 Line-Surge Protection: A lightning arrester and line-surge capacitor shall be provided on the incoming power service. The lightning arrester shall be of the 650-volt, 3 phases, “Transquell” type, as manufactured by General Electric Co., Cat. No, 9L15ECC001, Square D Model SDS3650, or approved equal. The line-surge protection device shall have field replaceable modules and a 20-yr warranty and shall be manufactured by MCG, model 120M or approved equal. The lightning arrester and line-surge capacitor shall be mounted outside the control panel.
- 417.21 Local Alarm: A visual red LED pilot lamp alarm shall be mounted in the enclosure.
- The local alarm shall be connected to the high level alarm, as described in Section 417.13, Submersible Electronic Pressure Transducer.
- 417.22 Installation: All electrical devices, conduit, wiring, and grounding must be installed and connected by a licensed electrical contractor. All electrical work shall comply with all local, state and federal electrical codes.
- 417.23 Power System Study – Short Circuit/Arc Flash: Provide a short circuit/arc flash analysis with two (2) copies of the report in accordance with the latest edition of NFPA 70E. All arc flash warning labeling shall be provided based on the findings of the study and in accordance of NFPA 70E. Following final approval of any of the power system study, the Contractor shall provide the complete digital system model and system library used to build the model and complete the study. All files needed to accurately recreate the study completed by the Contractor must be furnished and a backup of the system library used to define all system components must be provided.

418 Pump Station Electrical Service

- 418.01 Service Disconnect: After the electric meter, a fused disconnect or a circuit breaker shall be provided. The fused disconnect or circuit breaker shall be service entrance rated (per NEC 2017 Article 230.70), NEMA 4X. Provide one (1) additional class RK-5 fuse for each fuse needed. For a circuit breaker, provide a flange mounted main power disconnect operating handle with mechanical interlock having a bypass that will allow the panel door to open only when the switch is in the “OFF” position. A surge arrester shall be provided on the load side of the disconnect. The disconnect shall be padlockable in the on and off position.
- 418.02 Automatic Transfer Switch: Provide a four pole, NEMA 4X, automatic transfer switch with a switched neutral and ampere rating for the same electrical load as the Service Disconnect. The automatic transfer switch shall be located outside of the control panel. The automatic transfer switch shall have a dedicated terminal block for monitoring by the SCADA system. Manufacturers shall be ASCO, Caterpillar, Cummins Bridgeway, Kohler, or Schneider Electric.
- 418.03 Generator: Provide a liquid cooled, four stoke cycle, natural gas or diesel generator mounted on a structural steel base. If diesel fuel is to be utilized, the fuel tank base shall hold enough fuel to operate the generator at full load for a minimum of 24 hours.

The generator shall be in accordance with NFPA 110, Standard for Emergency and Standby Power Systems, Level 2, Type 60; NFPA 37, Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines; and NEC 701, Legally Required Standby Systems. The generator be built is in accordance with UL 2200, Stationary Engine Generator Assemblies.

Certify engine exhaust emissions in compliance with EPA Designation Emissions Standard under the provisions of 40 CFR 1048, control of Emissions for New, Large Non-road Spark-Ignition Engines, 40 CFR 60.4231, and 40 CFR 90.103 as they apply to non-road stationary emergency engines. Design the engine and fuel control system to limit the exhaust emissions of the engine to the limits imposed by these regulations, and submit certification.

The generator shall be provided with one adjustable trip, molded case, three pole, circuit breaker for three phase overloads and/or short-circuit protection. Current ratings shall be as required to protect the generator unit from overload or short circuit and shall be 100 percent continuous rated per NEC requirements to carry the full ampere load of the generator. The circuit breaker shall operate both manually or electrically for normal switching functions and automatically during overload and short-circuit conditions. The circuit breaker shall include contacts wired to the generator control panel to provide alarm if the breaker is in the "Tripped" or "Off" position.

The generator shall have an prefabricated level 2 sound enclosure with removable service doors that offers a sound reduction of 25 dB(A) at 7 meters using acoustic insulation, air inlet hoods, and air discharge hood. The exhaust system shall be of multi-chambered construction and critically silenced suitable for residential installation. A dedicated terminal block shall be provided for monitoring by the SCADA system. The generator shall be sized appropriately to handle the anticipated future electrical load of the station.

Shop test the complete engine driven generator unit and the generator control panel prior to shipment. Submit the complete certified test record. The tests shall demonstrate that the unit will operate successfully and meet the specified operational requirements. The manufacturer shall furnish all instruments, filters, fuel gas, electric power and load banks for the test.

Manufacturers shall be Cummins, Kohler, or approved equal.

Provide the services of a factory field representative to check the installation of the generator unit and appurtenances, to ensure installation in accordance with the manufacturer's recommendations, perform check-out and start-up services, and conduct the field test.

Mount the generator enclosure skid base on a concrete foundation and level to provide equal bearing for all supports as work of this Section. Utilize grout or other approved means to level the mounting surface of the foundation to provide equal bearing for all supports. Furnish and install concrete anchors as required. Connect the unit to field wiring and to fuel supply piping. Installation shall include furnishing all required coolant and lubricants in accordance with the manufacturer's recommendations.

Upon completion of installation and as soon as conditions permit, test the generator unit, controls, and appurtenances for acceptance, including load bank testing and operation under actual operating conditions, to demonstrate that operation is satisfactory. Before conducting the on-site field tests, submit a copy of the proposed field test log sheet. Prior to scheduling the test, notify the Owner in writing that all requirements and provisions of the Contract Documents have been fulfilled, that all apparatus has been cleaned, properly adjusted, and is ready for operation, and that the Operation and Maintenance manuals have been submitted.

Perform testing in the presence of the RPR. The test shall consist of four hours of continuous operation of the engine driven generator unit at unity power factor using a temporary portable resistive load bank. Load shall be adjusted, starting with half hour intervals each at 1/4 load,

1/2 load, and 3/4 load followed by the remaining time at full load. Furnish the load bank plus all connecting cables, metering equipment, and other equipment or devices required, and fuel to perform the load bank testing. During the test, take and record the following readings at fifteen minute intervals:

- a) Time
- b) Ambient temperature.
- c) Load:
 - 1. Volts for each phase
 - 2. Amps for each phase
 - 3. Kilowatts
 - 4. Frequency
 - 5. Power Factor
- d) Engine jacket water temperature
- e) Lubricating oil pressure

418.04 Miscellaneous items: The contractor shall pay all service and permit fees required for the installation of the electrical service. Any electrical inspections shall be completed prior to start-up and acceptance.

419 SCADA System

419.01 Sewage Lift Station Remote Unit (RTU-PLC) Requirements

- a) Installation Requirements:

The System Integrator shall supply the pump station SCADA equipment, housed in a NEMA 4/12 wall mount enclosure. The pump station enclosure shall include an internal power switch, bulkhead coaxial cable lightning arrestor, PLC, radio and a power line lightning arrestor as specified earlier.

The contractor will be responsible for the installation of the SCADA panel, including instrumentation, wiring, conduit and antenna. The contractor installation requirements shall be detailed by the System Integrator.

The antenna shall be mounted on a 10' long X 1-1/2" diameter mast secured to the side of the structure or on a 20' power pole with 3/4" rigid conduit and a weather-head run to the RTU enclosure, as previously specified.

- b) Front Panel Display Requirements:
 - 1. Keypad LCD Display
- c) Discrete Outputs:
 - 1. Pump #1 CALL
 - 2. Pump #2 CALL
 - 3. PLC Level Control "Normal" ("Failure" will activate back-up float pump control)
 - 4. spare
- d) Discrete Inputs:
 - 1. Power Failure
 - 2. Pump #1 RUNNING
 - 3. Pump #2 RUNNING
 - 4. Pump #1 FAIL
 - 5. Pump #2 FAIL
 - 6. Entry/Intrusion Alarm
 - 7. Backup Float Control "Active"

8. High Wetwell Level (from float switch)
 9. ATS Generator Active
 10. Generator Running
 11. Generator Alarm
 12. spare
- e) Analog Inputs:
1. Wetwell Level Indication (New Radar Level Sensor as specified earlier)
 2. Flow Rate/Total (Signal from Flow Meter, supplied by others)
 3. Pump #1 VFD Speed
 4. Pump #2 VFD Speed
 5. spare
- f) Analog Outputs:
1. Pump #1 VFD Speed Control
 2. Pump #2 VFD Speed Control

419.02 Sewage Lift Station Backup Float Control Panel Requirements

- a) Installation Requirements:
The System Integrator shall supply a “Backup Float Control Panel” in a NEMA 4/12 enclosure, with a UL-698A barrier section. The control panel shall operator the pumps, based off of float activation, in the event of a primary control failure (PLC or level sensor failure). The control panel will be composed of relay logic, timers, switches and lights. Electronic controllers, PLCs or processors will not be allowed for back-up pump control operation.
- b) Front Panel “Operational” Requirements:
1. Telemetry/Float Control Switch
 2. Float Control “Active” light
 3. Pump #1 Lead/Lag Switch
 4. Pump #1 Float Call Light
 5. Pump #1 Running Light
 6. Pump #2 Lead/Lag Switch
 7. Pump #2 Float Call Light
 8. Pump #2 Running Light
- c) UL-698 Explosion Proof Section:
1. Terminal blocks to interface to all Wetwell devices
 2. Intrinsically Safe Isolation module for the Radar Instrument
 3. Intrinsically Safe barrier for the float switches
- d) Float Control Operation:
1. Float: High Level Alarm
 2. Float: Lag Pump “CALL”
 3. Float: Lead Pump “CALL”
 4. Float: Low Level “Pump(s) OFF”

419.03 SCADA Integration: The SCADA System shall be built and integrated by Micro-Comm, Inc., 15895 S. Pflumm Rd, Olathe, KS 66062-8502, or an approved equal. The SCADA System shall be integrated into the County’s existing HMI.

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CHAPTER V – WATER LINES

501 Water Line Work

- 501.01 All work involving Muskingum County Water Department water lines will be performed in accordance with the Minimum Required Specifications and Installations Standards as stated in the Muskingum County Water Department Policies, Rules, and Standards. This information is available on the Internet at:
<https://www.muskingumcountyoh.gov/Agencies/Utilities/Water/Water-Rules/>

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CHAPTER VI – REFERENCE MATERIALS

See materials referenced in individual sections.

CHAPTER VII – STANDARD DRAWINGS

Muskingum County Standard Drawings Sheets 1-39