SECTION 02150

BYPASS PUMPING

PART 1- GENERAL

1.1 WORK INCLUDED

A. Contractor shall furnish, construct, maintain and operate bulkheads, plugs, hoses, piping, and pumps to bypass sewage flow while maintenance or construction operations are in progress. The flow shall be diverted by pumping around the construction location to a downstream manhole. Bypass pumping shall prevent backup or overflow onto streets, yards and unpaved areas or into buildings, adjacent ditches, storm sewers, and waterways, without diverting sewage outside of the sewer system.

B. Related Work Specified Elsewhere:

Section 02651, Television Inspection.

Section 02760, Cleaning of Sewers.

Section 02770, Pipe Lining.

1.2 QUALITY ASSURANCE

A. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction. The Contractor shall be responsible for damage due to sewer backup or overflow onto streets, yards and unpaved areas or into buildings, adjacent ditches, storm sewers, and waterways.

B. Some sewer flow data is available for Contractor's review upon request.

1.3 SUBMITTALS

A. Submittals shall conform to the requirements herein.

B. The Contractor shall submit, prior to installation, a detailed plan and description outlining all details and provisions of the temporary bypass pumping system. The plan shall be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to insure proper operation of the bypass pumping system, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. Nobypass pumping shall begin until all provisions and requirements have been reviewed and approved by the City of Massillon Engineer.

C. The bypass pumping plan shall include, but not be limited to, the following:

1. Staging areas for pumps;
2. Flow stoppage system, including pipe and channel plugging method and types of plugs;
3. Number, size, material, location and method of installation of pump suction piping;
4. Number, size, materials, method of installation and location of installation of discharge piping;
5. Number, size, materials, method of installation and location of installation of all valves;
6. Bypass pump sizes, capacity, number of each size to be on site and power requirements;

7. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted);
8. Size and location of standby power generator, if required;
9. Downstream discharge plan;
10. Any thrust and restraint block sizes and locations;
11. Any temporary pipe supports and anchoring required;
12. Calculations for selection of bypass pumping pipe size;
13. Schedule and for installation of and maintenance of bypass pumping lines;
14. Plan indicating location of bypass pumping line locations;
15. Method of noise reduction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Design piping, joints, and accessories to withstand at least twice the maximum system pressure or 50 psi, whichever is greater.

B. Pumps shall be self-priming type or submersible electric, in good working order, with a working pressure gauge. All power must be supplied by the Contractor. All pumps used must be constructed to allow dry running for extended periods of time to accommodate the cyclical nature of sewer flows.

C. Contractor shall provide one stand-by pump equal to the capacity of the largest pump on site.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL AND MAINTENANCE

A. Any time the bypass pumping system is operating, an experienced operator shall be on site to monitor the operation, adjust pump speed, valves, etc., make minor repairs to the system and report problems.

B. During bypass pumping, do not allow sewage to be leaked, dumped, or spilled in or onto any area outside of the existing sewer system.

C. In the event of accidental spill or overflow, immediately stop the discharge and take action to clean up, disinfect the spill and promptly notify the Owner.

D. Prevent back-up of sewage in sewer laterals within the areas of pipe being rehabilitated.

E. In the event of rain, the Contractor shall coordinate the operation of bypassing with the Owner.

F. The Contractor shall design his bypass pumping operation to handle all flows when bypass pumping. The Contractor is responsible for timing lining operations for dry weather conditions. Wet weather flows may significantly exceed peak dry weather flows.

G. Spare parts for each type of pump and piping shall be kept on site as required.

H. The bypass pumping operation shall be demonstrated to the satisfaction of the Engineer and Owner prior to starting rehabilitation work.

3.2 **INSTALLATION AND REMOVAL**

A. Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Owner.

B. During all bypass pumping operation, the Contractor shall protect existing structures and equipment from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the existing structures and equipment caused by human or mechanical failure. The Contractor is responsible for replacing any part of the manhole damaged during the bypass operation.

C. When working inside existing structures, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of gases, combustible or oxygen-deficient atmospheres, and confined spaces.

D. The Contractor is responsible for excavation and dismantling the manhole to allow the proper area for the bypass operation. Upon completion of the work, the Contractor shall restore the manhole to its original condition, and backfill the excavation according to the requirements of the agency having jurisdiction.

E. Bypass pumping and piping equipment shall be located on property and easements owned by the Owner. If additional property is required for operation and access to the Contractor's bypass pumping operation, the Contractor shall obtain written permission and agreements from the property owner and submit copies of the agreement to the Owner.

F. The pipeline must be located off streets and sidewalks and on shoulders of the roads. When the bypass pipeline crosses streets and driveways, the Contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Owner, the Contractor shall remove all the piping, restore all property to pre-construction condition and restore all pavement.

G. When bypass pumping operations are complete, piping shall be drained into the sewer prior to disassembly.

H. Noise reduction shall be required if bypass pumping is located within 300 feet of an occupied structure. The method of noise reduction shall be approved by the Engineer. Noise reduction shall result in a sound level of no more than 70 dBA at a distance of 30 feet from the pumps.

END OF SECTION

SECTION 02651

TELEVISION INSPECTION

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified, and required to perform Post- Installation television (TV) inspection of the influent sewer, as specified herein. Payment for this item shall be included in applicable sliplining item.

1.2 DEFINITIONS

A. Survey TV Inspection: Video inspection of sewer lines to determine existing conditions of the pipe. Survey TV Inspection for most lines has already been performed by the Owner and can be reviewed in the Office of the City Engineer. Any additional inspection shall be the responsibility of the Contractor.

B. Pre-Installation TV Inspection: Video inspection of sewer lines specified for rehabilitation to confirm cleaning and constructability of line rehabilitation.

C. Post-Installation TV Inspection: Video inspection to determine that rehabilitation of an existing sewer or construction of new sanitary sewers has been completed according to Specifications.

1.3 SUBMITTALS

A. Submit the TV equipment manufacturer's operating manual and guidelines to the Owner and Engineer for review. Strictly follow such instructions unless modified by the Owner or Engineer.

B. Submit three (3) copies of CD-ROMs, DVDs and TV Inspection logs, in a bound report, to the Owner or Engineer for review.

1. Provide CD-ROMs or DVDs of a quality sufficient for the Owner or Engineer to evaluate the condition of the sewer, locate the sewer service connections, and verify cleaning. If the Owner or Engineer determines that the quality is not sufficient, Contractor shall re-televise the sewer segment and provide a new CD-ROM or DVD and report at no additional cost to the Owner. Camera distortions, inadequate lighting, dirty lens, or blurred/hazy picture will be cause for rejection of a tape and rejection of the associated line segment. Payment for televised inspection will not be made until Owner or Engineer approves the quality of the CD-ROM, DVD and reports.

2. CD-ROM or DVD submitted become the property of the Owner.

3. Contractor shall maintain a master copy of all CD-ROMs, DVDs and TV Inspection Reports submitted, until final acceptance of contract.

4. The Post-Installation CD-ROMs or DVDs shall not be edited.

PART 2 – PRODUCTS

2.1 TELEVISION EQUIPMENT

A. Closed Circuit TV Equipment: Select and use closed-circuit television equipment that will produce a color CD-ROM or DVD.

B. Pipe Inspection Camera: Produce a CD-ROM or DVD using a pan-and-tilt, radial viewing, pipe inspection camera or a hand-held video camera that pans ± 275 degrees and rotates 360 degrees. Use an accurate footage counter to measure the exact distance of the camera from the centerline of the starting point. Use a camera with

camera height adjustment so that the camera lens is always centered at one-half the inside diameter, or higher, in the pipe being televised. Provide a lighting system that allows the features and condition of the pipe to be clearly seen. A reflector in front of the camera may be required to enhance lighting in humidity conditions. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor and other components of the video system shall be capable of producing a minimum 500-line resolution colored video picture. Picture quality and definition shall be to the satisfaction of the Engineer. If unsatisfactory, equipment shall be removed and no payment made for an unsatisfactory inspection.

C. Television Inspection Logs: Prepare printed location records to clearly identify the location of each source of infiltration or defect discovered using a standard stationing system. Other data of significance includes:

1. Estimation of extraneous flows observed from holes, joints, cracks, and from the annular space between rehabilitated sliplined pipe.
2. Unusual conditions.
3. Roots.
4. Cracked or collapsed sections.
5. Sags or low spots in the pipe.
6. Presence of scale and corrosion.
7. Structural deficiencies.
8. Signs of previous leakage.
9. Sewer line sections that the camera failed to pass through and reasons for the failure.
10. Other discernible features.

D. Data shall be recorded and a copy of the television inspection logs shall be supplied to the Owner or Engineer in the form of a bound report. A table listing acronyms and their meaning shall be included in the report. Contractor shall also supply the Owner a copy of the television inspection logs on an electronic file that is Microsoft Excel compatible.

E. Photographs: Take instant developing 35 mm, or other standard size photographs off the TV monitor of problem areas as directed to document defects, and unusual, questionable, or severe conditions found during the course of the Work.

F. Digital Video Disc: Provide digital video of the information in DVD format.

1. Two labels are required. One label shall be placed on the front of the CD-Rom or DVD and one place on the CD-ROM or DVD case. Permanently label each CD-ROM or DVD with the following information:

a. Spine of tape or CD-ROM or DVD case:

1) File Number.

2) Contractor’s Name.

3) Inspection Type: Pre or Post-Installation.

4) Tape Number.

5) Date Televised.

6) Date Submitted.

b. Face of tape or front of CD-ROM or DVD:

1) File Name/Description.

2) Pipe Diameter.

3) Pipe Length.

PART 3 – EXECUTION

3.1 TELEVISING

A. Immediately after cleaning, televise the sewer line to document its condition and to locate existing points of infiltration or other defects. Notify the Owner and Engineer 24 hours in advance of any TV inspection so that the Owner and Engineer may observe inspection operations. If conditions are shown that preclude the proper liner installation, even with cleaning, the Contractor shall notify the Owner and Engineer immediately.

B. Perform TV inspection of the sewer as follows:

1. Perform Survey TV Inspection immediately after cleaning.

    a. Move the camera through the line in either direction at a uniform rate, stopping when necessary to ensure proper documentation of the sewer's condition.

    b. Use manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions to move the camera through the sewer line.

    c. Quantify visible leakage of extraneous flow into the sewer or other sags or defects in the sewer and record on electronic log and audio/video recording. The video recording may be paused during observation. Record results of the flow observed on CD-ROM, DVD and inspection logs.

2. If needed perform Pre-Installation TV Inspection immediately after line cleaning and before line rehabilitation work. Pre-Installation TV Inspection is not required for sewer lines designated as remove and replace. Verify that the line is clean and ready to accept the line rehabilitation material. Maintain copies of CD-ROMs or DVDs and logs for reference by the Owner or Engineer for the duration of the Project.

3. Perform Post-Installation TV Inspection to confirm completion of rehabilitation work or proper installation of new sewers. Verify that the rehabilitation work or new sewer construction conforms to the requirements of the Specifications. Provide a color videotape showing the completed Work. Prepare and submit a log providing location of any discrepancies.

4. Camera shall pan beginning and ending manholes to demonstrate that all debris has been removed. Camera operator shall slowly pan clamped joints, and when pipe material transitions from one material to another. A log shall be completed for every segment that is submitted to the Owner.

5. Whenever non-remote powered and controlled winches are used to pull the television camera through the line, telephones, radios, or other suitable means of communication shall be set up between the operators positioned at the two manholes of the sewer lines being inspected to ensure that good communications exist between members of the crew.

6. The accuracy of the measurements for location of defects and service connections cannot be stressed too strongly. Marking on cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Measurement meters shall be accurate to two-tenths of a foot over the entire length of the sewer line section being inspected. Prior to recording the location of defects and service connections, slack in the cable of the television

inspection camera shall be taken up to assure metering device is designating proper footage. Accuracy of the measurement meters shall be checked daily by use of a walking meter, roll-a-tape, or other suitable device.

3.2 **FLOW CONTROL**

A. There shall be no flow in the line while performing Pre-Installation TV Inspection.

B. No flow will be allowed in the line while performing Post-Installation TV Inspection.

3.3 **PASSAGE OF TV CAMERA**

A. Do not pull or propel the television camera through the line at a speed greater than 30 feet per minute for Pre- and Post-Rehabilitation TV Inspection.

B. For Post-Installation TV Inspection, exercise the full capabilities of the camera equipment to document the completion of the rehabilitation work or proper installation of the new sewers. and the conformance of the Work to the Specifications. Provide a full 360-degree view of pipe and joints.

3.4 **FIELD QUALITY CONTROL**

A. Contractor shall not allow, under any circumstances, sewage or solids removed in the cleaning process to be released onto streets or into ditches, catch basins, storm drains, or storm sewer manholes, or cleanouts.

B. Acceptance of sewer cleaning work is contingent upon the successful completion of the TV inspection. If the TV inspection shows debris, solids, sand, grease, or grit remaining in the line, the cleaning will be considered unsatisfactory. Repeat cleaning, inspection, and televising of the sewer line until cleaning is satisfactory.

3.5 **ACCEPTANCE OF WORK**

A. Rehabilitation or completion of new sewer installation work shall only be accepted if no defects are found in the line upon TV inspection as determined by the Owner.

B. Contractor shall repair all defects to the piping in a manner acceptable to the Owner at no additional cost to the Owner.

END OF SECTION

SECTION 02760

CLEANING OF SEWERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified, and required to clean the pipelines.

B. The cleaning work required includes, but is not limited to, the following:

1. field locating all manholes along the sewer reaches to be cleaned;
2. cleaning of existing sanitary sewers, as hereinafter specified, to permit proper television inspection, installation of liner, and other rehabilitation techniques;
3. disposal of waste and sediment as specified herein;
4. removal of roots as specified herein;
5. cleaning up as the Work progresses and after the completion of all Work activities; and
6. all other work required for the complete and satisfactory cleaning of the pipeline.

C. Related Sections:

1. Section 02150, Bypass Pumping.
2. Section 02651, Television Inspection.
3. Section 02770, Pipe Lining.

1.2 REQUIREMENTS

A. The Contractor shall take precautions recommended by the manufacturer and all other precautions necessary in handling of root treatment chemicals. Chemical root treatment material to be used in strict compliance with all applicable federal, state and local requirements relative to type of material and usage thereof.

B. Take precautions to protect sewer mains and manholes from damage that might be inflicted by the improper selection of the cleaning process or improper use of the equipment. When using hydraulically propelled devices, take precautions to ensure that the water pressure created does not cause damage or flooding to public or private property. Do not surcharge the sewer beyond the elevation that could cause overflow of sewage into area waterways, homes, or buildings, or onto the ground.

C. While video of the sewers are available, the images are approximately two years old. The Contractor is responsible for determining current conditions for estimating amount of cleaning that may be required.

1.3 SUBMITTALS

A. Submit the following to Engineer for review:

1. Plan for disposal of debris and sediment removed from the sewer lines.
2. Specifications for the sewer cleaning equipment to be used on the project.
3. Specifications for the equipment to be used to remove sediment and debris at the downstream manhole of each reach to be cleaned.

PART 2 - PRODUCTS

2.1 CLEANING EQUIPMENT

A. All sewers shall be cleaned with truck-mounted, high velocity, hydro-cleaning equipment. The Contractor shall remove all unsound materials, debris, and grease by cleansing the interior surface using a minimum of 2,000 psi water spray pressure wash.

B. Provide equipment capable of removing all sand, dirt, rocks and other debris from the sewer reach to allow unobstructed remote television internal inspection of all internal surfaces, and other rehabilitation techniques.

C. All cleaning equipment, including machines, devices, and tools required for the entire cleaning operation shall be owned or leased and operated by the Contractor. The Contractor shall certify that backup cleaning equipment is available and can be delivered to the Site within 24 hours.

D. Any blockages of lateral building connections resulting from the cleaning or other items of Work shall be removed by cleaning of the building connection by the Contractor, at his own expense. Any damage caused by flood of lateral building connections shall be corrected by the Contractor, at his own expense.

E. Contractor shall provide all equipment capable of mechanically removing roots. Devices shall include a root saw, spring blade root cutter chuck or approved equal.

F. Hand-held pressure washers with a minimum of 1,000 psi of pressure may be used.

PART 3 - EXECUTION

3.1 CLEANING

A. After determining the preliminary requirements and the feasibility of effective video inspection, the Contractor shall thoroughly clean all pipeline reaches in order to permit an unrestricted inspection by closed circuit television. Particular emphasis shall be afforded the removal of accumulated grease, roots, sand, rocks, sludge and other debris so that the video inspection will show clearly all portions of the pipe being inspected. Acceptance of pipeline cleaning shall be made upon the successful completion of the television inspection and shall be defined as removing sufficient material to ensure an effective rehabilitation of the pipeline, to the satisfaction of the Engineer. If television inspection shows the cleaning to be unsatisfactory, the Contractor shall reclean and reinspect the pipeline at no additional cost to the Owner.

B. Contractor is responsible for obtaining necessary permits for obtaining water from Aqua Ohio, Inc. Contractor is responsible for following all rules and requirements of the Water Department. Backflow preventers shall be used to prevent contamination of the potable water system. The Contractor is responsible for any damage resulting from improper operation of hydrants. Do not use or obstruct a fire hydrant when there is a fire in the area. Remove water meters, fittings and piping from fire hydrants at the end of each working day.

C. Do not waste water from the public water supply because of improper connections or from hydrants left opened. If the Engineer or Owner determines that the Contractor is wasting water, the Owner may elect to charge the Contractor for water used on the project.

D. The Contractor shall remove all bricks, rocks, debris, sludge, dirt, sand, grease, roots and other materials from the sewers to be cleaned, and collect and remove the resulting debris from the downstream manholes of the sewer section being cleaned. Passing waste material between manholes will not be permitted. When necessary,

temporarily install a dam trap or weir and in the downstream manhole in such manner that debris and solids shall be trapped and retained for subsequent removal.

E. Remove waste and debris cleaned from the sewers at the downstream manhole by pumps or other means. The discharge and drainage stream shall be returned to the sewer and discharged downstream for disposal. Under no circumstances shall sewage or solids be dumped onto the ground surface, street, or into ditches, catch basins or storm drains. All solids and semi-solids shall be placed in a covered watertight container so that no spillage or leakage will occur and covered to minimize odors, and shall be disposed of by the Contractor. The Contractor is responsible for all operations and costs associated with removal, transportation, tipping and disposal of debris collected during the cleaning operations.

F. Where access to manholes in easements and rights-of-way is required, the Contractor will obtain permission for access for his equipment.

G. The Contractor shall conform to the following requirements:

1. Cleaning of upstream reaches of sewers shall be completed before the downstream reaches are cleaned;

2. Hydro-cleaning equipment shall be inserted in the downstream manhole of the reach, and the cleaning work shall proceed upstream; and

3. Winching equipment used shall not damage the existing pipelines.

END OF SECTION

SECTION 02490

LANDSCAPING AND SEEDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide lime, fertilizer, seed, and mulch as specified herein, and needed for a complete and proper restoration of all disturbed areas associated with the project.

1.2 QUALITY CONTROL

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 - PRODUCTS

2.1 FERTILIZER

A. Provide commercial balanced 12-12-12, (50% of Nitrogen shall be Urea form), uniform in composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags labeled with the manufacturer's guaranteed analysis. Uniformly apply 400 pounds per acre of premium fertilizer to a depth of at least 4 inches prior to seeding.

2.2 SOIL AMENDMENT

A. Apply agricultural limestone at a rate of one (1) tons per acre immediately prior to seedbed preparation.

2.3 MULCH

A. Provide threshed straw of cereal grain, such as oats, wheat, barley, rye, rice, etc., or grass hay, or wood fiber shall be furnished.

2.4 GRASS SEED

A. Seed mixtures with the following minimum percentage by weight of pure seed of each seed kind in the mixture in each lot shall be furnished and applied at a rate of 400 pounds per acre.

Table 1 Seed Mixture

Seed kind	Percentage by weight of each seed kind in mixture	Percentage by weight of pure live seed of each kind	Percentage by weight of live seed in mixture
Orchard Grass	55%	88%	48.4%
Perennial Ryegrass	25%	83%	20.7%
Japanese Millet	10%	90%	9.0%
Birds foot Trefoil	6%	90%	5.4%
Ladino Clover	4%	90%	3.6%

Total pure live seed in mixture 87.1%
Weed seed, not to exceed 1% by weight 1.0%
Other than weed and pure live seed, maximum . . . 11.9%
Total 100.0%

B. In the event that seeding is performed between October 15th and March 31st, uniformly apply one hundred (100) pounds per acre of annual rye in addition to the above-mentioned seed mixture.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 SOWING GRASS

A. Stage 1: Initial Dressing.

1. Rake or otherwise clear the disturbed area free of earth clods, debris, rocks, pipe, etc., and perform rough grading of the site in general conformance with the surrounding grade.

B. Stage 2: Final Dressing.

1. Grade all disturbed areas within the scope of the project to achieve final line and grades that tie smoothly to the surrounding grade and promote drainage.

2. Where the area to be seeded is not sufficiently pulverized to provide good seed bed, the seed bed shall be prepared by pulverizing the soil to a minimum depth of two inches (2") with a disk harrow, drag harrow, spike tooth or similar tool, immediately prior to seeding. All clods, rocks and undesirable material that would interfere with seeding operations shall be removed.

3. Apply lime uniformly at a rate of 1 ton per acre incorporated into the soil to a depth of at least 4 inches, fertilizer and seed immediately following seed bed preparation and lightly drag or rake to incorporate into the seed bed. Apply mulch immediately thereafter.

3.3 INSPECTION

A. In addition to normal progress observations, schedule and conduct the following formal inspections, giving the Engineer at least 24 hours advance notice of readiness for inspection:

1. Final inspection within 24 hours after completion of sowing

2. Final inspection at the end of the maintenance period as discussed in Item 3.04 in this section.

3.4 MAINTENANCE

A. Maintain seeding for 30 calendar days after planting is complete and continue throughout the warranty period until 95% coverage is achieved as determined by the COR.

B. At the end of the maintenance period, all plant material shall be in a healthy growing condition.

C. During the maintenance period, should the appearance of any planted area indicate weakness and probability of dying, re-sow that area without additional cost to the Government.

D. Continue the maintenance period at no additional cost to the Government until previously noted deficiencies have been corrected, at which time the final inspection will be made.

3.5 CONTROL OF EROSION

A. Provide and install temporary silt fence on the downstream side of excavated soil placed on embankments steeper than 4:1 (H:V) or otherwise specified on the Drawings or instructed by the COR.

END OF SECTION

SECTION 02830A

SLIPLINING OF STORM SEWERS AND CULVERTS USING SOLID-WALL HDPE PIPE

PART 1 - GENERAL

1. 1 SCOPE

A. Provide all materials, labor and equipment necessary to rehabilitate existing culverts and storm sewer pipes utilizing solid-wall high density polyethylene (HDPE) pipe.

B. In all instances, slip-lining rehabilitation shall include installation of a liner pipe having a constant Inside Diameter (ID) and Outside Diameter (OD) within an existing host pipe with a continuously grouted annular space.

PART 2 - REFERENCE STANDARDS

Unless otherwise noted, reference is made to the latest version of the documents listed below. All work shall comply with the following reference standards unless specifically stated otherwise in this Specification.

ASTM F585 – Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

ASTM D2657 – Standard Practice for Heat-Joining Polyolefin Pipe and Fittings

ASTM D3350 – Standard Specification for Polyethylene (PE) Plastic Pipe and Fittings Materials

ASTM D3261 - Standard Specification for Butt Heal Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

PART 3 - MATERIALS

3.1 PIPE

A. Pipe and fittings shall be manufactured from high density compounds in accordance with ASTM D3350, cell classification 345464C with a designation of PE 3408.
Pipe shall be solid wall and have a smooth interior and exterior with no corrugations or ferrous elements.

C. Pipe shall be marked at not less than 5 foot intervals with a coded number which identifies the manufacturer, SDR, size, materials, machine, date and shift on which the pipe was extruded.

D. All pipes shall be specifically applicable for installation and use in the environment as required by this specification.

3.2 **JOINTS**

A. Internal beads resulting from butt fusion shall be limited to a ¼" projection perpendicular to the inside wall of the pipe. Beads larger than ¼" shall be trimmed 360 degrees around the interior of the pipe. External beads resulting from butt fusion need not be trimmed unless the bead projection will negatively impact pipe installation or migration of annulus grout.

B. Joints shall be water-tight over the range of head pressure as specified as a design requirement in this Specification. In addition, all joints shall be sufficiently water-tight such that no grout is visible on the inside of the pipe at the completion of annular space grouting.

C. Joints shall be either butt-fused welded in accordance with ASTM D3261 and D2657, or push-together with interlocking machined grooves with approved sealant. Screw-type or threaded joints will not be allowed.

3.3 **FITTINGS**

A. Molded fittings shall be manufactured in accordance with ASTM D3261, and shall so marked.

B. Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings.

3.4 **GROUT**

A. Provide cementatious grout for annular space grouting in accordance with Section 03601 of these Specifications.

PART 4 - DESIGN REQUIREMENTS

The CONTRACTOR shall select, provide and install a slip-liner pipe that will meet all of the following requirements:

4.1 **CONVEYANCE CAPACITY**

A. The liner pipe shall provide the maximum conveyance capacity possible while maintaining a 1-inch minimum average annular space between the host pipe and liner pipe for grouting.

B. The ID of the liner pipe shall not be less than 80% of the nominal ID of the host pipe unless otherwise noted on the drawings.

C. The only exception to this shall be if the contractor satisfactorily demonstrates to the COR that it is possible to construct the project with commercially available pipe diameters and dimensions approved for use on this project.

4.2 **DESIGN CRITERIA**

A. The CONTRACTOR shall demonstrate that the selected liner pipe is suitable for installation based on a detailed evaluation given the following parameters:

1. All existing pipelines shall be considered fully deteriorated. The Contractor shall not give ANY structural consideration being provided by the host pipe.

2. Long-term analysis shall be considered 50 years.

3. Live load need not be considered.

4. Allowable long-term deflection is 5%.

5. All pipes shall be designed based on information shown on the enclosed drawings with depths field verified by the CONTRACTOR.

6. Use a Safety Factor of 2.0 for all parameters and calculations.

7. Modulus of soil reaction shall be 1500 psi.

8. Saturated unit weight of soil shall be 120 pcf.

4.3 **SUBMITTALS**

A. The CONTRACTOR shall provide six (6) bound copies of the following information to the City of Massillon for review and approval prior to construction:

1. Manufacturer's literature pertinent to the proposed rehabilitation materials and methods. Specific information should include installation minimum/maximum allowable parameters (i.e. allowable grout pressure, axial compressive stress, etc.), recommended installation procedures, etc.

2. Detailed analysis and calculations demonstrating suitable application based on the following parameters:

   a. Deflection

   b. Confined buckling

   c. Long-term (50 yr) hydrostatic buckling

3. Detailed Work Plan outlining the following items:

   a. Proposed construction sequencing and scheduling

   b. Areas requiring special construction techniques

   c. Proposed methods for control of water (if applicable)

   d. Proposed access and staging areas

   e. Proposed work hours

f. Other pertinent information related to the project

4. Test results and certification of compliance for materials.

5. Documentation of manufacturer's certification of installers (as applicable).

6. Grout design as per Section 03601.

7. Manufacture's recommendations regarding methods for repair of damage to liner pipe following installation.

PART 5 - EXECUTION

5.1 CLEANING AND INSPECTION

A. Prior to the installation of the slip-liner pipe, CONTRACTOR shall thoroughly clean the host pipes designated to receive the liner. Cleaning shall constitute removal of all debris, solids, roots, deposits, and other matter which would preclude proper installation of the slip-liner pipe and annulus grout. Water used for flushing and cleaning pipes prior to slip-line installation shall be maintained by the contractor to comply with regulatory agencies having jurisdiction regarding erosion prevention and sediment control procedures for storm water discharge.

5.2 CONTROL OF WATER

A. CONTRACTOR shall provide for maintenance and control of water as necessary for satisfactory installation of the slip-liner and grout. Such work shall include by-pass pumping or berming and dewatering for submerged pipes. Proposed means and methods for control of water shall be submitted for approval to the City of Massillon Engineer.

5.3 PROOF TESTING

A. A mandrel shall be pulled through all host pipes smaller than 36 inches in diameter where deformation, joint deflection or obstructions are observed prior to insertion attempts. The mandrel length of liner pipe shall be equal to the liner pipe joint length. Host pipes 36 inches in diameter and larger may be verified through man-entry, mandrel or both at the CONTRACTOR'S discretion. The mandrel shall have an outside diameter not less than that of the proposed slip-liner pipe plus 1-inch (note 1-inch grout requirement), shall be equal to the pipe joint length of the liner pipe to be installed and shall have a stiffness equal to or greater than that of the slip-liner pipe. A segment of slip-liner pipe may be used as a mandrel, but this test segment shall not be used as a permanent slip-liner pipe.

5.4 EXCAVATION

A. All work as required by these Specifications shall be performed utilizing existing points of entry including headwalls, manholes, etc. Any other excavation along the length of the host pipe (between headwalls/manholes) is strictly prohibited. In the event that it becomes necessary to perform an excavation, the CONTRACTOR will be

required to obtain written confirmation when an excavation is warranted from the City of Massillon.

5.5 **INSTALLATION**

A. All liner pipe installation shall be in accordance with the manufacturer's recommendations and the provisions of this Section. In the event of a conflict, the more restrictive of the two shall govern.

B. Sections of slip-liner pipe shall be joined and pushed into the host pipe until a continuous liner pipe is created along the entire length of the host pipe. Pulling assistance with a winch or other mechanical means is allowed provided that the entire section of slip-liner pipe remains in compression during installation from heavy equipment pushing the pipe from the other side. Heavy equipment or vehicles shall not be allowed to pull the pipe through.

C. Insertion may proceed from either upstream or downstream as suitable access is available, unless required otherwise.

D. A push ring that distributes jacking/pushing forces 360° around the perimeter of the end wall of the slip-liner pipe shall be used for all insertions to prevent damage to the slip-liner pipe.

E. An environmentally safe, sub-aqueous lubricant may be permitted upon prior approval by the City of Massillon.

F. The CONTRACTOR shall use caution to prevent jagged edges from damaging the slip-liner pipe during insertion when the invert of host pipe has deteriorated significantly. In such cases, the CONTRACTOR is encouraged to install two (2); 1 to 2 inch diameter Schedule 40 galvanized steel pipe guide rails along the invert of the host pipe. These guide rails shall be tack-welded or bolted to the host pipe to prevent movement during insertion and shall be withheld not less than 5 feet from the ends of the host pipe. The ends shall remain open such that the entire length of guide rail pipe shall be filled during annular space grouting. An alternate guide rail method may be prepared and submitted to the City of Massillon for review and approval.

G. The CONTRACTOR shall consider thermal expansion/contraction affects such that the ends of the slip-liner pipe is flush with the existing headwall/manhole to within ½ inch. Reasonable attempts shall be made by the contractor to achieve a flush surface between the slip-lined pipe and the host pipe as determined by the City of Massillon.

H. Once the slip-liner pipe has been installed, bulkheads shall be constructed in sequence from upstream to downstream at the end of each pipe segment; including gatewells and manholes located intermediately along the pipe length to be slip-lined. In addition, the shop drawings shall include the proposed locations of the grout/air ports and sketches of the proposed bulkheads, as well as the lengths of each grouting port. The lengths shall be staggered such that the entire run of the pipe can be completely grouted. Shop drawings shall include manufacturer's literature for accessories and form coating materials. The materials, dimensions, location of grout injection ports, vent tubes, etc. shall be designed by the CONTRACTOR and

submitted for approval per the requirements of Section 03601 of these Specifications. The CONTRACTOR shall construct bulkheads a minimum of 24 hours after the completion of the slip-liner insertion process to allow for thermal equilibrium between the slip-liner pipe and the host pipe conditions and at most 72 hours after completion of the slip-liner insertion process to minimize exposure of the annulus to debris from a rainfall event.

I. The contractor shall fill the annular space with grout between the ID of the host pipe and the OD on the liner pipe. The pipe shall be grouted along its entire length with cementitious grout. All materials, methods of grout installation shall be in accordance with Section 03601 of these Specifications.

J. The CONTRACTOR shall take necessary precautions to maintain line and grade of the host pipe and avoid flotation of the liner pipe. This can be accomplished by providing blocking at 10, 12, and 2 o'clock (suggested locations) in the top of the pipe to prevent flotation during grouting.

K. Drilling holes in the slip-liner pipe for any reason is prohibited.

L. At the completion of construction the exposed ends of all slip lined pipes shall have a clean, finished look with no visible signs of grout vents, injection tubes, etc.

M. The bulkheads shall be hand-finished with a portland cement based grout to a professional quality appearance that exhibits a reasonable attempt at matching the existing concrete surface. After a sufficient curing period, a soluble reactive silicate concrete treatment such as "Chem Tec One" should be applied over the entire headwall surface, including the bulkheads. Particular attention should be given to ensure the product is applied to the bulkhead grout properly.

5.6 SAFETY

A. The CONTRACTOR shall perform all work in accordance EM 385-1-1. The CONTRACTOR shall note any areas that may involve entry and/or work in confined spaces and provide a Health and Safety Plan including provisions for confined space entry to the City of Massillon prior to performing work in these areas. It shall be the CONTRACTOR'S sole responsibility to prepare, maintain, monitor and enforce his Health and Safety Plan as well as maintain compliance with EM 385-1-1.

PART 6 - QUALITY ASSURANCE

6.1 PERSONNEL AND EQUIPMENT

A. The CONTRACTOR shall at all times provide suitable equipment as well as adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods necessary for successful completion of the work.

6.2 SUPERVISION

A. The CONTRACTOR shall provide an experienced project superintendent as determined from resume submittals to be on the site at all time and shall have full

authority to direct the CONTRACTOR'S means, methods, equipment and personnel and performance of the work.

PART 7 - TESTING AND ACCEPTANCE

7.1 REWORK

A. The CONTRACTOR shall remove any material that has not received prior approval from the City of Massillon Engineer, has not been completed in accordance with these Specifications or is otherwise not accepted as suitable work by the City of Massillon Engineer and replaced with an approved material at the CONTRACTOR'S sole expense.

7.2 FINAL VIDEO INSPECTION

A. After all work is completed; the CONTRACTOR shall perform one CCTV inspection of all pipes at the CONTRACTOR's expense, documenting the post-installation conditions. This shall be provided to the City of Massillon Engineer for approval. All defects discovered during the post-installation video inspection shall be corrected by the CONTRACTOR at his expense before the work under the Contract will be considered for Substantial Completion. After the defects, if any, are corrected in accordance with manufacturer's recommendations, the affected pipe segment(s) shall be video inspected a second time as a follow-up inspection. All follow-up CCTV inspections will be performed by the CONTRACTOR, and all costs associated with such follow-up inspections associated with the correction of work shall be born by the CONTRACTOR and shall be withheld from final payment. The contractor shall provide final video to the City of Massillon Engineer for review and approval of finished work per pipe.

END OF SECTION

SECTION 03601

GROUT FOR SLIP-LINING NONSTRUCTURAL

PART 1 - GENERAL

1.1 SCOPE

Provide all materials, labor and equipment necessary to completely fill the annular space between the slip-liner pipe and the host pipe with low-strength (300 psi) cementitious grout. The Contractor should follow the specifications listed in the scope unless otherwise directed by the City of Massillon Engineer or unless otherwise recommended by the pipe manufacturer.

PART 2 - REFERENCE STANDARDS

Unless otherwise noted, reference is made to the latest version of the documents listed below. All

work shall comply with the following reference standards unless specifically stated otherwise in this Specification.

ASTM C403 - Test Method for Time Setting of Concrete Mixtures by Penetration Resistance

ASTM C138 - Test Method for Unit Weight

ASTM C150 - Portland Cement

ASTM C495 - Test Method for Compressive Strength of Lightweight Insulating Concrete

ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral

Admixture in Portland Cement Concrete

ASTM C939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)

ASTM C940-10a – Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory

ASTM C494 – Standard Specifications for Chemical Admixtures for Concrete

PART 3 - MATERIALS AND EQUIPMENT

3.1 CEMENT

A. Comply with ASTM C150. Pozzolans and other cementitious materials are permitted.

3.2 FLY ASH

A. Comply with ASTM C 618; either Type C or Type F shall be used.

3.3 **WATER**

A. Use only potable water obtained from a municipal water distribution system and transported, when required, in a clean, dedicated container designed specifically for such.

3. 4 **ADMIXTURE**

A. Admixtures shall be selected by the slip-lining grout manufacturer to meet performance requirements, improve pumpability, control set time, and reduce segregation. Admixtures shall not be biodegradable. Admixtures shall meet the requirements of ASTM C494 when applicable.

3.5 **COMPRESSIVE STRENGTH**

A. The grout shall have a minimum penetration resistance of 100 psi in 24 hours when tested in accordance with ASTM C403 and a minimum compressive strength of 300 psi in 28 days when tested in accordance with ASTM C495.

3.6 **PERFORMANCE REQUIREMENTS**

A. The grouting system shall have sufficient gages, monitoring devices, and tests to determine the effectiveness of the grouting operation and to ensure compliance with the liner pipe specifications and design parameters.

3.7 **MIX DESIGN**

A. The CONTRACTOR shall develop one or more mix designs to completely fill the annular space based upon, but not restricted to, the following requirements:

1. Size of annular void
2. Absence or presence of water
3. Sufficient strength and durability to prevent movement of the liner pipe
4. Provide adequate retardation for placement
5. Provide less than 1 percent shrinkage by volume
6. Heat of hydration compatible with pipe material in accordance with pipe manufacturer's recommendations
7. Shall have zero bleed
8. Specific Gravity greater than 1.0 when outer pipe is full of water (if applicable).

3.8 **MIXERS AND PUMPS**

A. The materials shall be mixed in equipment of sufficient size and capacity to provide the desired amount of grout material for each stage in a single operation. The system shall mix the grout to a homogeneous consistency and deliver grout to the injection point at a steady pressure with a non-pulsating pump at the mix tank. The equipment

shall be capable of mixing the grout at densities required for the approved procedures and shall also be capable of changing density as dictated by field conditions at any time during the grouting operation. The grout mixer shall be a high-speed, high-shear, colloidal type grout mixer capable of continuous mechanical mixing that will produce uniform and thoroughly mixed grout which is free of lumps and undispersed cement. The mixer shall be equipped with suitable water and admixture measuring devices calibrated to read in gallons and tenths and so designed that after each delivery the hands can be conveniently set back to zero. A paddle storage tank shall be used to agitate the mix prior to pumping.

3.9 **PRESSURE GAUGES**

A. Pressure gauges shall be suitable for use in the grouting environment and have a working range between 1.5 to 2.0 times the design grout pressures, and have accuracy within 0.5% of full range.

B. Provide, at a minimum, one pressure gauge at the point of injection and one pressure gauge at the grout pump.

3.10 **TESTING EQUIPMENT**

A. A Baroid Mud Balance shall be used to check the specific gravity during pumping operations.

PART 4 - SUBMITTALS

The CONTRACTOR shall provide six (6) bound copies of the following information to the City of Massillon Engineer for review and approval prior to construction:

A. Qualifications and experience of grout mix applicator and Project Superintendent and support personnel.

B. Grout mix design and trial mix tests, with set time, compressive strength, viscosity, and density test results.

C. Initial set time of the grout.

D. The 24 hour and 28 day minimum grout compressive strengths.

E. The grout working time before a 15% change in density or viscosity occurs.

F. The proposed grouting methods and procedures. Contractor shall submit a layout detail to include proposed locations for blocking, grout injection tubes and air vent tubes.

G. Method for waste grout recovery.

H. Estimated grout volume for each pipe per stage.

I. The maximum injection pressures proposed as well as maximum allowable grout injection pressures as provided by the pipe manufacturer.

J. Proposed grout stage volumes. Define the lengths of grout pipes for each stage. Stage lengths are limited to 20-30' unless justification can be provided as to the need for longer stages.

K. Bulkhead designs and locations including vent and injection port location and proposed materials to be used in bulkhead construction. In addition the lengths of each port shall be shown.

L. Method of flow control during grouting.

M. Detailed plans depicting the method of cribbing the liner pipe to allow the grout to set when buoyant uplift is a factor.

N. Written confirmation that the CONTRACTOR has coordinated grouting procedures with the grout installer and the liner pipe manufacturer. Confirmation shall also include that the CONTRACTOR has coordinated the attachment of the grout lines to the liner pipe so that they will not become clogged or detached during the installation process.

O. For each different type of grout or variations in procedure of installation, a complete package shall be submitted. The submittal shall include each of the above items and the locations of conditions to which it applies.

P. Detail measures or procedures to equalize the pressure between the inside and outside of the liner pipe so as to resist buoyant or bursting forces.

PART 5 - EXECUTION

5.1 GROUT INJECTION

A. Notify the City of Massillon Engineer at least 24 hours in advance of grouting operations. After installation of the injection ports and bulkheads, PVC caps shall be placed over the pipes to prevent any debris from entering the annular space.

B. Once the slip-liner pipe has been installed, construct bulkheads at each end in sequence from upstream to downstream. Following construction of the bulkheads, the CONTRACTOR shall fill the annular space between the slip-liner pipe and the host pipe along its entire length with cementitious grout by injecting grout from one end of the pipe segment, allowing it to flow toward the other end. Grouting should proceed from the downstream bulkhead toward the upstream end. Grouting should commence at the injection port on the downstream bulkhead and continue until:

1. Grout of similar specific gravity to that being mixed has been observed flowing from the downstream bulkhead vent and it has been closed.

2. The air or water displacing from the pipe stops flowing

3. The estimated total volume plus a percentage (approx. 10%), to allow for a tremie seal on the pipe, has been pumped.

Grouting should proceed from the longest line (say 100-110' in most instances) and progress through the successively shorter grout lines. Grout lines should be switched when:

1. The air or water displacing from the next shorter grout pipe stops flowing.

2. The estimated volume plus a percentage (approx. 10%), to allow for a tremie seal on the next shorter pipe, has been pumped.

C. Remove or control standing or running water in annular spaces to maintain the correct water ratio of the grout mixture.

D. Limit pressure on the annular space to prevent damage to the liner. The gauged grout pressure at the pipe shall not exceed that of the pipe manufacturer's recommendation or 5 psi, whichever is smaller. Regardless of the pressure, the CONTRACTOR shall be solely responsible for any damage or distortion to slip-liner pipe due to grouting.

E. The drilling of additional injection holes from the surface or through the liner pipe to facilitate grouting is prohibited.

F. Injection of grout shall continue until all of the following conditions have been achieved unless otherwise approved by the City of Massillon Engineer:

1. The total estimated volume of grout for all stages on a given pipe has been injected

2. The estimated volume of grout has been injected

3. The exhausted grout recovered at each vent is not less than 85% of the density of the freshly injected grout

4. The exhausted grout at each vent is not less than 85% of the original viscosity of the freshly injected grout

5. Grout recovered from the vent is the same specific gravity as that being injected, per the use of the Baroid Mud Balance

6. The grout installer recommends ceasing grouting operations.

G. No hardened grout is permitted in the liner pipe invert after completion of grouting operations.

H. Cold weather grouting where the temperature is between 32-40° F during and after grouting the following conditions shall be met:

1. Temperature of the grout mix must be 60° F or higher at the time of pumping.

2. The use of insulation/concrete blankets over areas of the levee behind the headwalls where the minimum cover above the frost line is not met for a period of 7 days.

I. Cold weather grouting when the temperature is below 32° F during and after grouting the following conditions shall be met:

1. Temperature of the grout mix must be 60° F or higher at the time of pumping.

2. The use of insulation/concrete blankets over areas of the levee behind the headwalls where the minimum cover above the frost line is not met for a period of 7 days.

3. The use of an interior heater in the pipe that does not exceed the pipes maximum localized temperature for the first 24 hours after grouting.

J. Hot weather grouting is permitted however, the CONTRACTOR shall use caution to prevent flash-setting of the grout. The CONTRACTOR is responsible for any replacement/repair necessary as a result of grouting in hot weather at no additional cost to the Government and to the satisfaction of the City of Massillon Engineer.

PART 6 - TESTING

6.1 DENSITY

A. Provide all personnel and equipment necessary to measure density in accordance with ASTM C138 or by another method as approved by the City of Massillon Engineer not less than two times per hour in the field during grouting operations. Grout that exceeds ±3 lb/cubic foot of the design density shall be rejected.

6.2 VISCOSITY

A. Provide all personnel and equipment necessary to measure viscosity in accordance with ASTM C939 not less than two times per hour in the field during grouting placement. The apparent viscosity shall not exceed 20 seconds unless otherwise approved by the City of Massillon Engineer.

6.3 COMPRESSIVE STRENGTH

A. Collect, transport, cure, test and report samples in accordance with ASTM C495.

B. Collect four (4) specimens (3”x6” cylinders) for each pipe at approximately the mid-point of the grouting operation.

C. Test all specimens for compressive strength at 28 days. Additional specimens and tests may be performed at the CONTRACTOR’S discretion.

D. Tests and companion specimens associated with oven-dry unit weight (ASTM C495 Item 9) are not required.

E. The CONTRACTOR shall engage the services of an independent, COE Certified Testing Laboratory to collect and test specimens associated with the strength requirements of this Section. In addition, all field personnel associated with testing shall be from a COE Certified Testing Laboratory.

6.4 **BAROID MUD BALANCE**

A. Provide all personnel and equipment necessary to test specific gravity with the Baroid Mud Balance in accordance with established procedures in the field during grouting placement.

END OF SECTION

SECTION 03617

CURED-IN-PLACE PIPE (CIPP)

PART 1 - GENERAL

1.1 INTENT

A. It is the intent of this specification to provide for the reconstruction of pipelines and conduits by the installation of a resin-impregnated flexible tube, which is tightly formed to the original conduit. The resin is cured using either hot water under hydrostatic pressure or steam pressure within the tube. The Cured-In-Place Pipe (CIPP) will be continuous and tight fitting.

PART 2 - REFERENCED DOCUMENTS

2.1 This specification references standards from the American Society for Testing and Materials, such as: ASTM F1216 (Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube), ASTM F1743 (Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)), ASTM D5813 (Cured-in-Place Thermosetting Resin Sewer Pipe), ASTM D790 (Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials), and D2990 (Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics) which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

PART 3 - PRODUCT MANUFACTURER/INSTALLER QUALIFICATION REQUIREMENTS

3.1 PRODUCTS

A. Since sewer products are intended to have a 50-year design life, and in order to minimize the Owner's risk, only proven products with substantial successful long-term track records will be approved. All trenchless rehabilitation products and installers must meet all of the following criteria to be deemed Commercially Acceptable:

1. For a Product to be considered Commercially Proven, a minimum of five successful wastewater collection system projects of a similar size and scope of work shall be performed in the U.S. and documented to the satisfaction of the Owner to assure commercial viability

2. For an Installer to be considered as Commercially Proven, the Installer must satisfy all insurance, financial, and bonding requirements of the Owner, and must have had at least 5 (five) years active experience in the commercial installation. In addition, the Installer must have successfully installed at least 1,000,000 feet of a cured-in-place product in wastewater collection systems. Acceptable documentation of these minimum installations must be submitted to the Owner. Installer's project managers must have a minimum of 2 years of CIPP installation experience and must be on-site during the installation of the CIPP products.

3. Sewer rehabilitation products submitted for approval must provide third party test results supporting the structural performance (short-term and long-term) of

the product and such data shall be satisfactory to the Owner. No product will be approved without independent third party testing verification.

4. Both the rehabilitation manufacturing and installation processes shall operate under a quality management system which is third-party certified to ISO 9000 or other recognized organization standards. Proof of certification shall be required for approval.

5. The owner authorizes the use of proven materials that serve to enhance the pipe performance specified herein. Proven materials have passed independent laboratory testing, not excluding long-term (10,000 hour) structural behavior testing, and have been successfully installed to repair failing host pipes in the U. S. for at least 4 years. In addition to the aforementioned, the owner may require that the contractor demonstrate that the enhancements proposed exceed the specifications herein, prior to the installation of the enhanced material systems. This section in no way shall be interpreted as authorization to deviate from the minimum standard practices set forth herein.

PART 4 - MATERIALS

4.1 TUBE

A. The sewn Tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216, Section 5.1 or ASTM F1743, Section 5.2.1 or ASTM D 5813, Sections 5 and 6. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections. The tube may also contain felt layers reinforced with glass or carbon fibers.

1. The wet out Tube shall have a relatively uniform thickness that when compressed at installation pressures will equal or exceed the calculated minimum design CIPP wall thickness.

2. The Tube shall be manufactured to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during installation..

3. The outside layer of the Tube shall be coated with an impermeable, flexible membrane that will contain the resin and allow the resin impregnation (wet out) procedure to be monitored.

4. The Tube shall contain no intermediate or encapsulated elastomeric layers. No material shall be included in the Tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.

5. The wall color of the interior pipe surface of CIPP after installation shall be a relatively light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

6. Seams in the Tube shall be stronger than the non-seamed felt material.

7. The Tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 ft. Such markings shall include the Manufacturers name or identifying symbol. The tubes must be manufactured in the USA.

4.2 **RESIN**

A. The resin system shall be a corrosion resistant polyester or vinyl polyester system including all required catalysts, initiators that when cured within the tube create a composite that satisfies the requirements of ASTM F1216, ASTM D5813 and ASTM F1743, the physical properties herein, and those which are to be utilized in the submitted and approved design of the CIPP for this project. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification.

PART 5 - STRUCTURAL REQUIREMENTS

5.1 The CIPP shall be designed as per ASTM F1216, Appendix X.1. The CIPP design shall assume no bonding to the original pipe wall.

5.2 The Contractor must have performed long-term testing for flexural creep of the CIPP pipe material installed by his Company. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. This is a performance test of the materials (Tube and Resin) and general workmanship of the installation and curing as defined within the relevant ASTM standard. A percentage of the instantaneous flexural modulus value (as measured by ASTM D790 testing) will be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. Retention values exceeding 50% of the short-term test results shall not be applied unless substantiated by qualified third party test data to the Owner's satisfaction. The materials utilized for the contracted project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in the CIPP design.

5.3 The Enhancement Factor 'K' to be used in 'Partially Deteriorated' Design conditions shall be assigned a value of 7.

5.4 The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If the layers separate during field sample testing, new samples will be required to be obtained from the installed pipe. Any reoccurrence may cause rejection of the work.

5.5 The cured pipe material (CIPP) shall conform to the structural properties, as listed below.

MINIMUM CIPP PHYSICAL PROPERTIES

Property	Test Method	Cured Polyester Composite min. per ASTM F1216	Cured Polyester Composite Enhanced Resin
Modulus of Elasticity	ASTM D790	250,000 psi	400,000 psi
Flexural Stress	ASTM D790	4,500 psi	4,500 psi

5.6 The required structural CIPP wall thickness shall be based as a minimum, on the physical properties in Section 5.5 or greater values if substantiated by independent lab testing and in accordance with the design equations in the Appendix X1. Design Considerations of ASTM F1216, and the following design parameters:

Design Safety Factor (typically used value)	= 2.0
Retention Factor for Long-Term Flexural Modulus to be used in Design	= 50% - 75
(As determined by long-term tests described in section 5.2 and approved by the Owner)	
Ovality* (calculated from (X1.1of ASTM F1216)	= %
Enhancement Factor, K	=See Section 5.3
Groundwater Depth (above invert of existing pipe)*	= ft.
Soil Depth (above crown of existing pipe)*	= ft.
Soil Modulus**	= psi
Soil Density**	= pcf
Live Load**	=H20 Highway
Design Condition (partially or fully deteriorated)***	= ***

* Denotes information, which can be provided here or in inspection videotapes or project construction plans. Multiple lines segments may require a table of values.

** Denotes information required only for fully deteriorated design conditions.

*** Based on review of video logs, conditions of pipeline can be fully or partially deteriorated. (See ASTM F1216 Appendix) The Owner will be sole judge as to pipe conditions and parameters utilized in design.

5.7 Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

PART 6 - TESTING REQUIREMENTS

6.1 CHEMICAL RESISTANCE

A. The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical-testing requirements.

6.2 HYDRAULIC CAPACITY

A. Overall, the hydraulic cross-section shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

6.3 CIPP FIELD SAMPLES

A. When requested by the Owner, the Contractor shall submit test results from field installations of the same resin system and tube materials as proposed for the actual

installation. These test results must verify that the CIPP physical properties specified in Section 5.5 have been achieved in previous field applications. Samples for this project shall be made and tested as described in Section 10.1.

PART 7 - INSTALLATION RESPONSIBILITIES FOR INCIDENTAL ITEMS

7.1 It shall be the responsibility of the Contractor to locate and designate all manhole access points open and accessible for the work. If a street must be closed to traffic because of the orientation of the sewer, the Contractor shall request such closing and coordinate with the Director of Public Service and Safety. The Contractor must coordinate with Aqua Ohio, Inc. and pay any associated fees to for the access to water hydrants for cleaning, installation and other process related work items requiring water and any costs relating to the usage of water shall be included in the applicable item.

7.2 Cleaning of Sewer Lines shall pertain to section 02760. The Contractor, when required, shall remove all internal debris out of the sewer line that will interfere with the installation of CIPP. The Contractor shall also be responsible for the safe removal of all debris removed from the sewers during the cleaning operation.

7.3 Bypassing Sewage shall pertain to section 02150. The Contractor, when required, shall provide for the flow of sewage around the section or sections of pipe designated for repair. Plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system shall make the bypass. The pump(s) and bypass line(s) shall be of adequate capacity to accommodate the sewage flow. The Owner may require a detail of the bypass plan to be submitted.

7.4 Inspection of Pipelines shall pertain to section 02651. Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections using close circuit television (CCTV) inspection techniques. The pipeline interior shall be carefully inspected to determine the location of any conditions that may prevent proper installation of CIPP. These shall be noted and corrected. A videotape and suitable written log for each line section shall be produced for later reference by the Owner.

7.5 Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the installation process and it cannot be removed by conventional sewer cleaning equipment, then the Contractor shall make the necessary repair of the obstruction.

7.6 Public Notification - The Contractor shall make every effort to maintain sewer service usage throughout the duration of the project. In the event that a connection will be out of service, the longest period of no service shall be 8 hours. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:

A. Written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor they can call to discuss the project or any potential problems.

B. Personal contact with any home or business, which cannot be reconnected within the time stated in the written notice.

7.7 The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing the CIPP.

PART 8 - INSTALLATION

8.1 CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, with the following modifications:

A. Resin Impregnation

1. The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the potential loss of resin during installation through cracks and irregularities in the original pipe wall, as applicable.

B. Tube Insertion

1. The wet out tube shall be positioned in the pipeline using either inversion or a pull-in method as defined within relevant ASTM standards previously stipulated. If pulled into place, a power winch or its equivalent should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.

C. Temperature gauges shall be placed between the tube and the host pipe's invert position to monitor the temperatures during the cure cycle.

D. Curing shall be accomplished by utilizing hot water under hydrostatic pressure or steam pressure in accordance with the manufacturer's recommended cure schedule. A cool-down process shall be conducted that complies with the resin manufacturer's specification.

PART 9 - REINSTATEMENT OF BRANCH CONNECTIONS

9.1 It is the intent of these specifications that branch connections to buildings be re-opened without excavation, utilizing a remotely controlled cutting device, monitored by a CCTV. The Contractor shall certify a minimum of two complete functional cutters plus key spare components are on the job site before each installation or are in the immediate area of the jobsite and can be quickly obtained. Unless otherwise directed by the Owner or his authorized representative, all laterals will be reinstated. No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such excavation and restoration work.

PART 10 - INSPECTION

10.1 CIPP samples shall be prepared by the Contractor for each installation designated by the owner/engineer or approximately 20% of the project's installations. Pipe physical properties will be tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either method proposed. The flexural properties must meet or exceed the values listed in the table on page 4 of this specification, Table 1 of ASTM F1216 or the values submitted to the Owner/engineer by the contractor for this project's CIPP wall design, whichever is greater.

10.2 Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than 87½% of the submitted minimum design wall thickness as calculated in paragraph 5.6 of this document.

10.3 Visual inspection of the CIPP shall be in accordance with ASTM F1743, Section 8.6.

PART 11 - CLEAN-UP

11.1 Upon acceptance of the installation work and testing, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

END OF SECTION