

DIVISION 2

SITE WORK

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SECTION 02101

SITE INVESTIGATION

PART 1 – GENERAL

1.1 SITE CONDITIONS

A. The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon transportation, disposal, handling, and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, groundwater table or similar physical conditions at the site, the conformation of subsurface materials to be encountered, the character of equipment and facilities needed prior to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with all available information concerning these conditions will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 02101

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## SECTION 02435

### MANHOLE REHABILITATION

#### PART 1 - GENERAL

##### 1.1 WORK INCLUDED:

- A. This Section covers the rehabilitation of sewer and drain manholes as called for herein and on the Drawings. It is the intent of this specification to provide for the waterproofing, sealing, and structural enhancement of existing manholes by chemical grout exterior sealing of sewer manhole inverts, walls and corbels; and by application of a uniform cementitious layer of high-quality mortar. An additional corrosion resistant monolithic high-build epoxy lining system shall be installed in addition to the cementitious liner. Additional manhole rehabilitation related items include manhole root removal and build manhole bench and invert.
- B. The work shall include: elimination of infiltration by external chemical grout sealing; removal and patching of loose and/or unsound material; cleaning and preparation of surfaces; repair of invert, bench, and walls; chemical grout sealing of the invert, bench, walls, and pipe connections; and application of a cementitious mix and epoxy system to form a liner. Other repairs shall be completed as indicated on the Drawings and described herein.
- C. The Contractor shall furnish all equipment, material and labor required to perform all manhole rehabilitations described in this specification.
- D. External grouting of inverts, bench, walls, corbel, and pipe connections shall be performed prior to application of liner system.

##### 1.2 RELATED WORK:

- A Drawings and general provisions of DIVISION 0 - BIDDING AND CONTRACT REQUIREMENTS and other DIVISION 1 Specification Sections, apply to this section.
- B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.
  - 1. Section 02538 – Temporary By-Pass Sewage Pumping

##### 1.3 QUALITY ASSURANCE:

- A. The Work described herein shall be performed by a company with not less than five (5) years of experience in providing the required services, employing experienced workers and experienced supervisory personnel. Supervisory personnel shall have not less than three (3) years of experience in providing the required services and shall be present at

the jobsite during all work related to the required services.

1.4 REFERENCES:

- A. The following standards form a part of this specification as referenced:

The National Association of Sewer Service Companies (NASSCO) Recommended Specifications for Sewer Collection System Rehabilitation (Current Edition).

ASTM F2551	Standard Practice for Installing a Protective Cementitious Liner System in Sanitary Sewer Manholes
ASTM C94	Ready-Mix Concrete
ASTM C109	Comprehensive Strength
ASTM C267	Chemical Resistance
ASTM C596	Shrinkage
ASTM C666, Method A	Freeze/Thaw Resistance
ASTM D4414	Standard Practice for Measurement of Wet Film Thickness for Organic Coatings
ASTM 543	Resistance of Plastics to Chemical Reagents
ASTM 638	Tensile Properties of Plastic
ASTM 695	Comprehensive Properties of Rigid Plastics
ASTM D790	Flexural Properties of Unreinforced and Reinforced Plastics

1.5 LINING SYSTEM DESCRIPTION:

- A. Unless otherwise indicated herein, sewer manhole sealing shall be carried out in accordance with the current edition of PERFORMANCE SPECIFICATION GUIDELINE FOR MANHOLE REHABILITATION, of NASSCO Recommended Specifications for Sewer Collection System Rehabilitation.
- B. The Contractor may propose alternative processes and/or products for review and approval by the Engineer.
- C. The locations of the manhole lining work to be completed are as shown on the Drawings.

1.6 SUBMITTALS:

- A. Prior to beginning the work, submit six (6) sets of the following:
- a. Qualifications of the firm/personnel who will perform the Work.
  - b. Provide at least five (5) references of different projects in which at least 50 manholes have been rehabilitated by the firm within the past three (3) years.
  - c. Description of the system, equipment and material with MSDS proposed for sewer manhole rehabilitation.

- d. Description of the system proposed for bypass pumping during the procedures to be carried out.
- e. Manufacturer's warranty

1.7 WARRANTY:

- A. The manhole rehabilitation work performed shall be warranted against infiltration and faulty workmanship and materials for a period of one (1) year after the project is accepted by the Owner.

PART 2 - PRODUCTS

2.1 REHABILITATION MATERIALS:

All products used for lining, sealing, patching, and cleaning shall be environmentally safe. The contractor shall submit MSDS Data Sheets for all materials used.

2.2 SEALING OF INVERT, STOPPING ACTIVE LEAKS AND EXTERIOR CHEMICAL SEALING:

The contractor shall use a chemical grout that is environmentally safe for the sealing of sewers. The chemical grout shall be in accordance with CHEMICAL SEALING (GROUTING) MATERIALS of the NASSCO Standard Specifications.

2.3 PATCHING MIX:

A quick-setting cementitious material shall be used as a patching mix and is to be mixed and applied according to the manufacturer's recommendation and shall have the following minimum requirements.

Compressive Strength	ASTM C-109	6 hr 1,400 psi
Shrinkage	ASTM C-596	0% AT 90% Relative Humidity

2.4 INFILTRATION CONTROL MIX:

A rapid-setting cementitious product specifically for leak control shall be used to stop water infiltration and shall be mixed and applied according to the manufacturer's recommendations and shall have the following minimum requirements.

Compressive Strength	ASTM C-109	1 hr 600 psi
Compressive Strength	ASTM C-109	24 hr 1,800 psi

2.5 CEMENTITIOUS LINER MIX:

- A. The cementitious liner mix shall be used to form a structural enhancing monolithic liner

covering all interior manhole surfaces and shall have the following minimum requirements at 28 days:

Compressive Strength	ASTM C-109	6,000 psi
Shrinkage	ASTM C-596	0%, 90% humidity
Freeze/Thaw Resistance	ASTM C-666	No visible damage after 100 cycles

- B. The liner mix shall be applied in one monolithic layer.

2.6 CORROSION PROTECTIVE COATING (EPOXY LINER)

- A. The corrosion protective coating shall be a 100% solids, solvent-free two-component epoxy resin system thixotropic in nature and filled with select fillers to minimize permeability and provide sag resistance acceptable to the following specifications:

Volatile Organic Compounds (vol %)	ASTM D2584	0%
Flexural Strength	ASTM D790	13,000 psi
Compressive Strength	ASTM D695	18,000 psi
Tensile Strength	ASTM D638	7,600 psi
Tensile Elongation	ASTM D638	1.50 %
Hardness, Type D	ASTM D2240	88
Adhesion	ASTM D4541	>Tensile Strength of Concrete (substrate failure)
Chemical Resistance	(ASTM D543)	Sulfuric Acid, 10% Immersion Service

2.6 BRICK MATERIALS:

- A. Brick shall be sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the Engineer. Bricks shall comply with ASTM C32. Grade SS shall be used for inverts and shelves, and Grade MS shall be used for applications other than inverts and shelves. Rejected brick shall be immediately removed from the work and brick satisfactory to the Engineer substituted.
- B. Concrete Masonry Units: Concrete masonry units shall be made from hydraulic cement, water, and suitable mineral aggregates, and conform to ASTM C139.
- C. Mortar shall be composed of Portland cement, hydrated lime, and sand in which the volume of sand shall not exceed three times the sum of the volumes of cement and lime. Mortar for Grade SS Brick shall be mixed in the volume proportions of 1:1/2:4-1/2; Portland cement to hydrated lime to sand.
- D. Cement shall be Type II Portland cement as specified for concrete masonry.



- E. Hydrated lime shall be Type S conforming to ASTM C207.
- F. Sand shall comply with ASTM C144 specifications for “Fine Aggregate,” except that all of the sand shall pass a No. 8 sieve.

2.7 CONCRETE:

- A. Cement shall be domestic Portland Cement conforming to ASTM C150, Type II.
- B. Fine aggregate shall be washed natural sand conforming to ASTM C33.
- C. Coarse aggregate shall be well graded crushed stone conforming to ASTM C33, size No. 67.
- D. No admixtures shall be used unless approved by the Engineer in writing.

2.8 WATER:

Water used in mixing shall be potable.

2.9 DELIVERY, STORAGE, AND HANDLING:

- A. Materials shall be delivered to the site in the Manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. All materials shall be stored properly and in accordance with Manufacturer’s instructions.

PART 3 - EXECUTION

3.1 SAMPLING AND TESTING OF LINER:

- A. The Owner reserves the right to test all materials.
- B. Products that fail to meet the requirements of these specifications shall not be incorporated in the work.

3.2 SURFACE PROTECTION:

- A. During progress of work, where appearance is important, adjacent areas or grounds which may be permanently discolored, stained, or otherwise damaged by dust and rebound, shall be adequately protected and, if contacted, shall be cleaned by early scraping, brushing or washing, as the surroundings permit.
- B. No street markings shall be removed or covered throughout the progress of work.

### 3.3 EXISTING FLOWS:

The Contractor shall divert flows as required for the work and in accordance with the requirements specified in Section 02538 - TEMPORARY BY-PASS SEWAGE PUMPING.

### 3.4 CEMENTITIOUS LINING:

#### A. PREPARATION

1. Remove all foreign material from the manhole wall and bench using a high-pressure water spray (minimum 5,000 psi). Loose and protruding brick, mortar, and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with quick-setting patching mix. Surfaces to be repaired shall be clean and free of loose materials. Additional surface preparation shall be as recommended by the manufacturer of the materials to be applied.
2. Leaks shall be stopped using a chemical grout, which shall be applied as per the manufacturer's recommendations. Leaks may require weep holes drilled at the manhole base to localize the infiltration during the application, after which the weep holes shall be sealed with a chemical grout and plugged with the quick-setting infiltration control mix prior to the final liner application. Areas with evidence of previous leakage (e.g., mineral deposits) shall also be grouted.
3. All pipe connections in brick manholes shall be grouted regardless of whether they are leaking or have signs of previous leakage. Grout ports shall be located near the pipe connections to ensure that the sealing material is injected at the manhole/pipe connections. Grout ports shall be located and drilled in the bench and invert for all brick manholes as necessary to seal the manhole base.

#### B. INVERT SEALING

1. The Contractor shall carry out all work as described in SEWER MANHOLE SEALING 3 (3.1) of the NASSCO Standard Specifications using sealing materials and procedures accepted by the Engineer. Grout ports shall be located in the invert and base of the manhole. The Contractor shall also ensure that sealing material is injected at the manhole/pipe connections. A quick setting patch mix shall be troweled uniformly not to exceed ½-inch, onto the damaged invert extended out onto the base of the manhole sufficiently to tie into the structurally enhanced monolithic liner to be applied. The finished inverts shall create a smooth transition between the manhole invert and cured-in-place liner. Application of the quick setting patch mix will not be required in manholes that will have a cured-in-place liner through the invert. The locations are as indicated on the plans.

#### C. INTERIOR SEALING

1. Interior lining of the manholes shall be conducted only after all other manhole rehabilitations have been completed.
2. Unless otherwise indicated herein, the Contractor shall carry out all work as described in SEWER MANHOLE REHABILITATION, CEMENTITIOUS LINER, of the NASSCO Standard Specifications using lining materials and procedures accepted by the Engineer.
3. Preparation, as described in the above referenced NASSCO specification, shall be completed prior to the placement of the cementitious liner.
4. Sealant shall not be placed on a frozen surface or during freezing weather. Sealant shall not be placed when it is anticipated that the temperature during the following 24 hours will drop below 32 degrees, Fahrenheit.
5. Pipes and/or service connections shall be temporarily plugged prior to the application of the cementitious manhole interior liner. A flash coat of the liner material shall be applied three (3) inches into each service connection. Temporary plugs shall be removed once the liner has cured sufficiently to prevent erosion of the new liner.
6. Thickness shall be verified with a wet gauge at random points of the new interior surfaces as required by the Engineer. Minimum thickness of one-half (½) inch is required.
7. Application shall be with low velocity, continuous flow equipment to prevent the adverse effects of rebound. A smooth trowel finish shall be applied.
8. The Contractor shall prohibit debris from entering the invert by either covering the invert or plugging during application.

#### D. DIGITAL PHOTOGRAPHS

1. The Contractor shall take a digital photograph of the interior of each manhole, before and after rehabilitation, in JPEG format. Filenames shall contain manhole designations. Digital photographs shall have a minimum resolution of ten (10) megapixels.

### 3.5 CORROSION PROTECTIVE COATING

- A. Installation of the corrosion protective coating shall not commence until the cementitious liner material has properly cured and been prepared in accordance with manufacturer recommendations.
- B. The specified corrosion protective coating shall be applied utilizing manufacturer approved heated plural component spray equipment. The protective coating shall be applied in two coats to achieve 125-250 mil average thickness. The second coat of the

protective coating should occur as soon as the basecoat becomes tack free, ideally within 12 hours but no later than the recoat window for the specified product. Additional surface preparation procedures are required if this recoat window is exceeded.

### 3.6 REPAIR MANHOLE CORBEL, INVERT AND BENCH:

- A. Existing manhole bench and invert (including debris, brick, block, and mortar) shall be removed and disposed of.
- B. Bricks shall be moistened by suitable means, as directed, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.
- C. Each brick shall be laid as a header in a full bed and joint of mortar without requiring subsequent grouting, flushing or filling, and shall be thoroughly bonded as required.
- D. Channels and shelves shall be constructed of brick and concrete as shown on the Drawings. The brick lined channels shall correspond in shape with the lower half of the pipe. The top of the shelf shall be set at the elevation of the crown of the highest pipe and shall be sloped 1 inch per foot to drain toward the flow through channel. Brick surfaces exposed to sewage flow shall be constructed with a nominal 2-inch by 8-inch face exposed (i.e. bricks on edge).

### 3.7 MANHOLE GROUTING TO STOP LEAKS:

- A. The Contractor shall drill grout ports at all leaks. Chemical sealing material shall be pumped through the grout ports to seal the exterior of the manhole. Areas with evidence of previous leakage (e.g., mineral deposits) shall also be grouted. Grout ports shall be plugged with the quick-setting infiltration control mix following completing of grout installation.
- B. The Contractor shall prohibit debris from entering the invert by either covering the invert.
- C. The chemical sealing material used shall be as described in chemical sealing (grouting) materials of the NASSCO Standards Specification.
- D. The Contractor shall be aware of the potentially close proximity of grout ports to underdrain piping. The Contractor shall take care in making sure grout is not pumped into the underdrain during this process.

### 3.8 FIELD TESTING/INSPECTION:

- A. Material Testing: One 2 x 2 inch sample cube shall be taken for every 50 bags of cementitious lining material used. Samples shall be sprayed from the nozzle of the application equipment, identified and sent to an independent test laboratory for compression strength testing as described in ASTM C109.
- B. Thickness Testing: During application of the corrosion protective coating a wet film

thickness gage, such as those available through Paul N. Gardner Company, Inc. meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used to ensure a monolithic coating and uniform thickness during application.

- C. **Holiday Testing:** After the protective coating has set hard to the touch it shall be inspected with high-voltage holiday detection equipment. Surfaces shall first be dried, an induced holiday shall then be made on to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional protective coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the protective coating manufacturer's recommendations.
- D. **Bond Strength:** Measurement of bond strength of the protective coating to the substrate shall be made at regular intervals and along different sections of the structure. Bond strength shall be measured in accordance with ASTM D4541. Any areas detected to have inadequate bond strength shall be evaluated by the Project Engineer. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Applicator in strict accordance with manufacturer's recommendations.
- E. Prior to the expiration of the warranty period, the Contractor shall inspect each of the sewer manholes rehabilitated during this project in accordance with SEWER MANHOLE SEALING of the NASSCO Standard Specifications at a time where groundwater is sufficiently high as determined by the Engineer. The Contractor shall repair any defects found, there shall be no leaks and no evidence of previous leakage.
- F. All inspecting, testing, and reworking within the warranty period shall be provided at no additional cost to the Owner.

END OF SECTION

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## SECTION 02440

### PIPELINE CLEANING AND INSPECTION

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION OF WORK

- A. Clean and inspect the pipelines indicated on the Drawings or as directed by the ENGINEER in a manner that is compliant with the guidelines set forth within this section. This Work includes furnishing all equipment and labor required to perform the services described herein.

##### 1.2 QUALITY ASSURANCE

- A. Refer to Section 01400 – QUALITY ASSURANCE, for qualification requirements.

##### 1.3 REFERENCES:

- A. The following standard is referenced as part of this specification:

The National Association of Sewer Service Companies (NASSCO) Recommended Specifications for Sewer Collection System Rehabilitation (Current Edition).

##### 1.4 SUBMITTALS

- A. Submit detailed television inspection reports as specified herein. Submit inspection reports and DVD video record for review and approval by ENGINEER weekly, minimum.
- B. DVD shall provide a visual and audio record of conditions encountered in the pipeline and shall have an associated database that can be searched, sorted, stored, and transferred with all associated software at no additional cost. Database shall be compatible with Microsoft Excel or Access software.
- C. Upon substantial completion of the Work submit one complete set of DVDs of TV inspection Work.
- D. Refer to Section 01300 – SUBMITTALS, for required documentation to be submitted.

#### PART 2 – PRODUCTS

##### 2.1 CLEANING EQUIPMENT

- A. Pipe cleaning equipment shall consist of high velocity jet equipment as defined in the section SEWER LINE CLEANING of NASSCO (current version).

- B. High velocity jet equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size and length lines indicated on the Drawings. Equipment shall also include a high velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.
- C. Self-propelled robotic cutters used to remove pipe obstruction and re-instate lateral connections shall be self-propelled with various types of cutting and grinding heads. The robot shall also have the ability to spray water on cutting heads and on the lens. The cutter shall be manned by an operator in a climate controlled studio inside of a specially outfitted cutting truck with room for an operator and an observer. The cutting truck shall provide electricity, compressed air and water in support of the self-propelled robot.

## 2.2 TELEVISION EQUIPMENT

- A. TV inspection equipment shall meet the standard set under TELEVISION INSPECTION, MAIN SEWERS of NASSCO (current version).
- B. Television equipment shall include television camera, television monitor, cables, power source, lights, and other equipment. The television camera shall be specifically designed and constructed for operation in connection with sewer inspection.
- C. Lighting for the camera shall be suitable to allow a clear picture, with minimal reflective glare, for the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor and other component of the video system shall be capable of producing a minimum 400 line resolution color video picture. Picture quality and definition shall be to the satisfaction of the ENGINEER.
- D. The camera shall have a remote controlled, pan and tilt type lens and lighting system capable of turning perpendicular to the direction of flow and rotating 360 degrees while inside the pipe. The camera shall be able to view a minimum service connection length of 4 feet in order to determine whether the connection is active or inactive.
- E. The remote reading footage counter shall be accurate to one (1) foot over the length of the particular section being inspected.

## PART 3 – EXECUTION

### 3.1 ACCESS TO WORK

- A. Certain conditions may prevent the CONTRACTOR from completing portions of the work contained herein. Upon discovery of such conditions, the CONTRACTOR shall immediately notify the ENGINEER who will in turn notify the OWNER and attempt to arrive at a resolution. The ENGINEER will then direct the CONTRACTOR to



either return to the location once the condition is remedied or will remove the subject pipe from the project. These decisions will be made at the ENGINEER's sole discretion and no additional cost will be incurred for eliminating, re-scheduling or returning to areas of the work as long as the CONTRACTOR is working on other areas of the project. These conditions include but are not limited to the following:

1. Paved over or otherwise buried manholes.
2. Obstructions in the pipe
3. High flow conditions
4. Need for police detail or traffic control measures

### 3.2 PIPE CLEANING

- A. The CONTRACTOR shall use high velocity jet as described in the most recent version of NASSCO Standard Specifications.
- B. All sludge, dirt, sand, rocks, grease, and other solid or semisolid material resulting from the cleaning operation shall be disposed of in accordance with all applicable regulations and in a method acceptable to the OWNER. Pipe cleaning shall be performed in advance of pipe television inspection.
- C. The CONTRACTOR shall be responsible for the legal removal, transportation and disposal of all debris removed from the pipelines during the cleaning operation including any costs incurred. The OWNER shall allow disposal of sewer/drain pipeline matter in the OWNER's sewer/drain system as appropriate.
- D. Light cleaning shall be conducted at a minimum to permit the passage of the closed circuit television camera. Acceptance by the ENGINEER of the cleaning results will be based on the results of television inspection. If the results are unsatisfactory, the CONTRACTOR shall repeat the cleaning until accepted by the ENGINEER at no additional cost to the OWNER.
- E. The CONTRACTOR shall coordinate water use with the OWNER. CONTRACTOR shall be responsible for providing, installing and using all equipment needed to obtain water from hydrants in accordance with the OWNER's requirements.

### 3.3 HEAVY SEWER CLEANING

- A. The Contractor shall remove all obstructions in the sewer. All debris shall be removed from the sewer, including any debris that may have been washed up into any service connections (does not include known pre-existing conditions in service connections), drop connections or the bench wall of the manholes. This includes all grease, rocks, debris, fine roots, sticks, etc. that will reduce the hydraulic capacity of the sewer and limit future maintenance access of remote equipment. This work will include an unlimited number of passes by high velocity hydro-cleaning equipment. A mechanical/hydraulic Spinner Nozzle, chain cutters, and other special nozzles may be used where necessary at no additional cost to the Owner.
- B. The Contractor shall be responsible for any damage to the sewer or any service connection.

- C. The Contractor shall immediately notify the Owner and Engineer if he believes that this level of cleaning will cause a sewer collapse due to the existing deterioration of the host pipe. The Owner and Engineer will determine whether to continue or stop work.

### 3.4 LATERAL CUTS

- A. The Contractor shall cut/grind the protruding service connection by using a remote grinding/cutting device capable of removing, concrete, vitrified clay, PVC and other types of pipe material. The Contractor shall use remote CCTV equipment to monitor the progress of the work and ensure that the service connection is not damaged.
- B. A protruding break-in service connection shall be cut/ground flush to the main sewer pipe without scouring or damaging the main sewer or service connection. All cuttings must be screened, collected, and removed from the sewer for proper disposal.
- C. A final survey television inspection shall be conducted by the Contractor and shall slowly pan the entire circumference of the trimmed connection to verify the quality of the work.
- D. The Contractor shall immediately notify the Owner and Engineer if he believes that the pipe is not structurally sound. The Engineer or Owner shall determine, if the work should continue to be performed.
- E. If other than typical lateral materials are encountered, the Contractor shall notify the Engineer and Owner.

### 3.5 DEBRIS RECORDS

- A. The Contractor shall keep records of types of debris removed from each segment of pipe and provide these records to the Engineer and Owner in the format requested by the Engineer or Owner.

### 3.6 PIPE INSPECTION

- A. Pipe shall be visually inspected by means of closed-circuit television. The television camera used for the inspection shall be one specifically designed and constructed for such inspection.
- B. DVD Recordings: Electronic video equipment shall display and record during the entire inspection at a minimum the following data for each pipeline reach video recorded.
  - 1. Date recorded
  - 2. Footage counter
  - 3. Voice over narration noting any significant observations made during the inspection work, including the following:
    - a. Length, size and type of pipe.
    - b. Location of offsets and misalignments of any part.
    - c. Location and type of defect in pipe such as cracks, holes, etc.
    - d. Protruding service connections.

- e. Root intrusion.
  - f. Visible infiltration/inflow sources estimated in gallons per minute (GPM).
  - g. Type and depth of debris in pipe.
  - h. Sluggish flow or wastewater backing up into manhole.
  - i. Overall condition of pipe section (from manhole to manhole).
4. Pipeline reach identification (street location, MH to MH)
- C. DVD and Television Logs: The CONTRACTOR shall prepare individual log sheets of each line section inspected, recording, at a minimum, the following information in tabular and graphic format, and submit duplicate copies electronically to ENGINEER at regular intervals not exceeding weekly intervals:
- 1. Project identification
  - 2. List of Subcontractors at the site.
  - 3. Count of personnel at the site, by job classification.
  - 4. List of major equipment utilized on site.
  - 5. Numbered pages including an index sheet listing the pipeline segments, street name and corresponding page of the report they are located.
  - 6. Tabular and graphic display observation made during the inspection work as listed herein.
  - 7. Pipeline reach identification (street location, MH to MH)
- D. The camera shall be moved through the line in either direction at a uniform rate, stopping when necessary to ensure proper identification of the pipeline's condition. In no case will the television camera be pulled at a speed greater than 20 feet per minute. 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 pipeline conditions may be used to move the camera through the line.
- E. If, during the inspection operation the television camera will not pass through the entire pipeline section, the CONTRACTOR shall reset his equipment in a manner so that the inspection can be performed from the opposite manhole.
- F. Flow control shall be in accordance with Section 02538 – TEMPORARY BY-PASS PUMPING.
- G. Standing water within a sagging pipe shall be removed so that the pipe can be adequately television inspected. A minimum of 80% of the pipe shall be visible before television inspection. A minimum of one attempt using standard cleaning equipment shall be made to clear lines surcharged due to line sages. The CONTRACTOR shall maintain a list of line segments that are significantly surcharged and provide this list to the ENGINEER daily.
- H. Television inspection shall be performed in advance of all testing and rehabilitation activities.
- I. Accuracy of the measurement meters shall be checked daily by use of a walking meter, roll-a-tape, or other device approved by the ENGINEER. The measurements recorded in the log shall be zeroed at the point the camera lens begins the pipeline penetration of the upstream manhole, unless specific permission is given by the

ENGINEER to do otherwise. Footage shall be shown on the video data view at all times and will be zeroed at the beginning of each run.

END OF SECTION 02440

## SECTION 02538

### TEMPORARY BY-PASS SEWAGE PUMPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions - BIDDING AND CONTRACT REQUIREMENTS and other DIVISION 1 Specification Sections, apply to this section.

##### 1.2 SUMMARY

- A. Furnish, install, field test, and operate temporary by-pass pumping systems for the purpose of diverting sewage flow around work areas for the duration of the project. The pumping system shall protect against surcharging of the existing sewer system upstream of the work area by installing adequate temporary by-pass pumping to handle dry weather and wet weather flows. Provide all labor, tools, materials, and equipment necessary to by-pass flow around the work areas.
- B. The design, installation, and operation of temporary by-pass pumping systems shall be the Contractor's responsibility. The by-pass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
- C. By-pass operations shall be continuously monitored by the Contractor, regardless of duration or timing of by-passing. By-pass should be coordinated with low-flow times, to the extent feasible. Restore normal service to entire system at the end of normal working hours every day or post an attendant on-site. No unattended by-pass pumping will be allowed.
- D. Maintain temporary by-pass pumping systems so that they are completely functional throughout the required period of service.
- E. Provide all maintenance including manufacturer recommended preventative maintenance and on-call repair services. Contractor shall provide repair services and/or replacement equipment 24 hours per day, 7 days per week within 4 hours of being notified.
- F. The Contractor shall not allow sewage flow to discharge to any salt or fresh water body by means of overflow, by-pass pumping, or any other method that may contaminate these water areas.
- A. Except as specifically permitted, the installation of the by-pass pipelines is prohibited in all saltmarsh/wetland areas. The pipeline must be located off streets and sidewalks and on shoulders of the roads. When the by-pass pipeline crosses local streets and private driveways, the Contractor must place the by-pass pipelines in a portable hose ramp, or place temporary bituminous pavement, cold patch, or other approved material to

form a ramp on each side of the pipe to the satisfaction of the Engineer or by depressing the pipe as directed by the Engineer.

- G. The ramp shall be high load bearing capacity. Upon completion of the by-pass pumping operations, the Contractor shall remove all piping, restore all property to pre-construction condition, and restore all pavement. The Contractor is responsible for obtaining any approvals from the Owner for placement of the temporary pipeline within public ways.
- H. Related Sections: The following sections contain requirements that relate to this Section:
  - 1. Section 02435 – Manhole Rehabilitation
  - 2. Section 02440 – Pipeline Cleaning and Inspection
  - 3. Section 02764 – Cured-In-Place Pipe (CIPP)
  - 4. Section 02765 – Lateral Connection Repair (LCR)

### 1.3 SUBMITTALS

- A. Submit the following in accordance with the Conditions of Contract and Division 1 Specification Sections and as specified herein:
  - 1. A detailed description of the proposed pumping systems, project approach, and requirements here within:
  - 2. A detailed description of each proposed temporary by-pass pumping system including pumps, pump drives, piping, hoses, valves, fittings, controls, wiring, and other ancillary accessories required to provide a complete operating system.
  - 3. Complete list of system components to be provided.
  - 4. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
  - 5. Performance data for each type of equipment that will show compliance with specification requirements stated herein.
  - 6. Detailed plans and sections showing the proposed pumping system layout. Plan shall include but not limited to the following:
    - a. Staging area and access requirements for all pumps.
    - b. Number, size, material, location, and method of installation of suction piping.
    - c. Number, size, material, location, and method of installation of discharge piping.
    - d. Sewer plugging method and types of plugs.
    - e. Pump size, capacity, number of units, fuel tank capacity, fuel consumption requirements, and method of refueling.

7. Emergency response plan describing the intended means of handling but not limited to the following:
  - a. Break or failure of by-pass piping.
  - b. Failure of by-pass pump.
  - c. Overflows.
  - d. Backup into dwelling or onto private property.
  - e. Operations during inclement weather including snow storms.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 - Quality Assurance and as specified.
- C. The by-pass pumping system shall be standard equipment and totally suited for the application as detailed herein. The equipment to be furnished shall be satisfactory and safely designed, in accordance with the design parameters as detailed in these contract documents. It shall be constructed for continuous, automatic operation, for extended periods of time.
- D. All items shall be designed and constructed in full accordance with all applicable state and local codes and regulations. Labor, materials, and costs required to meet state codes shall be the responsibility of the Contractor and the professional by-pass pumping company.

#### 1.5 FLOW DATA

- A. The project area consists of active sanitary sewers; therefore, flows and flow data are variable depending on location and conditions. It is the responsibility of the Contractor to maintain flows in accordance with this specification under all flow conditions and, therefore, the Contractor is encouraged to visit the project locations prior to Work to visually inspect flow conditions.

### PART 2 - MATERIALS

#### 2.1 PUMPING EQUIPMENT

- A. Each temporary by-pass pumping system shall be complete including pumps, drives, piping, piping headers, valves, flow meter, controls, and appurtenances as required for a complete system.
- B. The pumps, drives, and controls shall be designed and built for 24-hour continuous service at any and all points within the required range of operation, without overheating, without cavitation, and without excessive vibration or strain. All parts shall be so designed and proportioned as to have the strength, stability, and stiffness and be constructed to meet the specified requirements. Methods shall be provided for inspection, repairs, and adjustment.

- C. All equipment shall be suitable for outdoor operation under adverse weather conditions. Provide protection from freezing as required to maintain system operation.
- D. Each pump shall be able to pass typical municipal sewage.
- E. Pumps shall be provided with noise protective acoustically-silenced enclosures that meet all local, MA DEP, and Local construction noise requirements and as a minimum: 80 dBA at seven feet; 65 dBA at thirty feet; 60 dBA at nearest residence; and less than 10 dBA raised above background levels; and no pure tone condition. Contractor shall be responsible for all materials, labor, and equipment to show compliance with the above requirements.

## 2.2 ADDITIONAL EQUIPMENT

- A. Provide all required suction and discharge pipe and fittings, discharge manifold pipe and fittings, shutoff valves, check valves, flow meter, pressure regulating valves, insulation, freeze protection, and all required accessories.
- B. All pipe and fittings shall be steel with flanged or quick connect coupling connections, or high density polyethylene pipe with fused joints or approved equal. Joints shall be Victaulic or equal. Suction piping shall be rated for 25-in Hg vacuum. Discharge piping, fittings, connections, valves, and other discharge piping accessories shall be rated for a minimum working pressure of 150 psi.
- C. Lay flat hose shall be extra heavy duty, highly abrasive resistant and fitted with gasketed couplings. Hose shall be rated for a minimum working pressure of 150 psi.
- D. Aluminum "irrigation" type piping or glued PVC pipe will not be allowed.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. The Contractor must provide for 100% redundancy (two pumps shall be provided AT THE SITE for every one pump required) if flow cannot be returned to the sewer at any time if pumping system failure occurs. Redundant pump shall include suction and discharge piping.
- B. The Contractor shall adequately handle all flow, even instantaneous peak flows, without damage or overflow. The Contractor shall make himself aware of potential large instantaneous flow contributors connected to the sewer.
- C. Plugging or blocking of sewage flows shall incorporate primary and secondary plugging devices. When plugging or blocking is no longer needed for performance and acceptance or Work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.



- D. The by-pass pumping system shall not require excavation to reduce the suction lift without approval of the Engineer. Pumps may not be benched down to make the suction lift unless approved by the Engineer.
- E. 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.

### 3.2 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610 - Delivery, Storage, and Handling and as specified herein. Ship equipment, materials and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
- C. Deliver spare parts at same time as pertaining equipment.
- D. Store and safeguard equipment, material, and spare parts.

### 3.3 INSTALLATION

- A. Install pumping units on a firm level surface.
- B. Equipment failing to meet specific conditions shall be removed and replaced at no additional cost to the Owner.

### 3.4 FIELD TEST AND QUALITY CONTROL

- A. The piping system must provide adequate water tightness. The Engineer may require the Contractor to perform a leakage test with clean water if in the Engineer's sole opinion the piping system appears as though it may leak.
- B. Any such testing shall be to the Engineer's satisfaction and shall be at the Contractor's expense.
- C. In the event that a unit fails to pass a test, make all modifications required to place the unit in proper working order.
- D. In the event that a unit fails a test a second time, remove the unit and replace with a satisfactory one, at no cost to the Owner.
- E. The Contractor shall provide all necessary instrumentation, equipment, devices, and appurtenances, as well as temporary wiring or piping, required to perform field tests.

### 3.5 SYSTEM OPERATION

- A. The by-pass pumping operations must be attended at all times. Unattended by-pass will not be allowed. If by-pass pumping must continue past working hours an attendant must be present at all times.
- B. Perform all required maintenance on the equipment to maintain the system integrity and capacity as specified.
- C. Provide clean-up and disposal of contaminated material and reporting for all product spills.
- D. At the completion of the period of service, disconnect all temporary piping and remove all system components from the site. Restore the work site to its original condition

### 3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 - Contract Closeout.

END OF SECTION 02538

## SECTION 02764

### CURED-IN-PLACE PIPE (CIPP)

#### PART 1 - GENERAL

##### 1.1. SUMMARY

- A. The scope of Work includes the rehabilitation of sewer pipe via the installation of a resin-impregnated flexible tube which is inverted into the original conduit in accordance with ASTM F1216. The resin is cured by hot water or steam to form a hard, impermeable, corrosion resistant pipe. When cured, the finished pipe will be continuous and tightly formed to the original conduit.

##### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of DIVISION 0 - BIDDING AND CONTRACT REQUIREMENTS and other DIVISION 1 Specification Sections, apply to this section.
- B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.
- C. The following items of related work are specified and included in other Sections of the Specifications:
  - 1. Section 01170 – SPECIAL PROVISIONS
  - 2. Section 02440 – PIPELINE CLEANING AND INSPECTION
  - 3. Section 02538 – TEMPORARY BY-PASS PUMPING
  - 4. Section 02765 –LATERAL CONNECTION REPAIR (LCR)

##### 1.2. QAULITY ASSURANCE

- A. The work described herein shall be performed by a company with not less than five (5) years of experience in providing the required services, employing experienced workers and experienced supervisory personnel. Supervisory personnel shall have not less than three (3) years of experience in providing the required services and shall be present at the jobsite during all work related to the required services.

##### 1.3. SUBMITTALS

- A. The CONTRACTOR is required to provide the following documentation as a minimum:

1. Personnel Experience – Submit evidence of personnel experience as required under 1.2 QUALITY ASSURANCE.
  2. CONTRACTOR's experience – The CONTRACTOR shall provide evidence of previous installations of the product bid for this project as installed by the CONTRACTOR. Contact names and telephone numbers shall be provided for 5 recent projects to verify the CONTRACTOR's experience level.
  3. Description of materials and installation process, including manufacturer name and material specifications.
  4. Third party testing and verification of design approach. This data shall support the design calculation described below. This data shall verify that the design format utilized by the CONTRACTOR has been independently reviewed and verified.
  5. Long-term creep data (50 years), including third party verification. This data shall include the long-term results of the product bid for this project. The long term physical properties of the CIPP as determined via this testing cannot be exceeded in the design calculations utilized to calculate the liner wall thickness.
- B. Prior to beginning the work, the CONTRACTOR shall submit a written plan for contacting homeowners whose service connections may be affected due to the installation of liner. Such plan is subject to approval by the ENGINEER and the OWNER.
- C. The CONTRACTOR shall submit the following information for each inversion within 21 days following completion of the liner installation.
1. Pre-inversion television inspection logs and DVDs
  2. Liner order sheet describing the material ordered
  3. Service connection reinstatement sign-off sheet
  4. Thermocouple log kept during inversion process
  5. Post-inversion television inspection logs and DVDs
  6. Material testing results
  7. Information should be organized by inversion and two (2) electronic copies on DVD shall be delivered.
- D. The CONTRACTOR shall prepare and obtain the MWRA One-Time-Only Discharge Request Permit as described in Specification Section 01170 – SPECIAL PROVISIONS.

#### 1.4. WARRANTY

- A. The CONTRACTOR shall make all necessary repairs and replacements to remedy, and at no cost to the OWNER, any and all defects, breaks, or failures of the Work occurring within one (1) year following the date of acceptance of the Work due to faulty or inadequate materials or workmanship.

#### 1.5 REFERENCED DOCUMENTS

- A. This specification references ASTM F1216 and F1743 which are made a part of hereof by such reference and shall be the latest edition and revision thereof. ASTM F1216 and/or F1743 shall govern when this specification does not address installation methods and materials. If there is a conflict between ASTM F1216 and/or F1743 and this specification, this specification will govern.
- B. The following standard is referenced as part of this specification. The National Association of Sewer Service Companies (NASSCO) recommended specifications for sewer collection system rehabilitation cured-in-place pipe (Insituform Process)

### PART 2 – PRODUCTS

#### 2.1. MATERIALS

- A. Cured-in-place pipe shall be as manufactured by Insituform Technologies, National Liner, Inliner Technologies, or approved equal.
- B. The sewer tube shall consist of one or more layers of absorbent, non-woven felt fiber and shall meet the requirements of ASTM F1216, Section 5.1.
- C. The wetout tube shall have a uniform thickness that when compressed at installation pressures will meet or exceed the design thickness.
- D. The tube shall be fabricated to a size that when installed will tightly fit the internal circumference and length of the original pipe. The tube shall be constructed to withstand inversion pressure, have sufficient strength to bridge missing pipe, stretch to fit irregular pipe sections and shall invert smoothly around bends. Allowance shall be made for circumferential stretching during inversion. Overlapped layers of felt that cause lumps in the final product shall not be allowed
- E. The outside layer of the CIP tube (before wetout) shall be coated with a translucent flexible polyethylene material that is compatible with the resin system used and allows inspection of the impregnation procedure. The coating shall not be subject to delamination after cure. The plastic coating shall separate the resin from the inversion water without leakage, accommodate inversion, stretch to size and shall not delineate before, during or after cure.

- F. The CIPP shall be homogeneous across the entire wall thickness and shall contain no intermediate or encapsulated elastomeric layers. No materials shall be included in the tube that is subject to delamination in the cured CIP). No dry or unsaturated layers shall be evident.
- G. The bond between CIPP layers shall be strong and uniform. All layers, after cure, must form one homogenous structural pipe wall with no part of the tube left unsaturated by resin.
- H. Seams in the tube shall be stronger than the unseamed felt. Where the length requires joining, the sewn joint shall not be perpendicular to the long axis but spirally formed and sewn.
- I. The outside of the tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 feet. Such markings shall include the Manufacturers name or identifying symbol.

#### 2.1. RESIN

- A. The resin system shall meet the requirements of ASTM F1216, Section 5.2.

#### 2.2. STRUCTURAL REQUIREMENTS

- A. The CIPP shall be designated as per ASTM F1216, designed to have sufficient strength to handle dead loads, live loads, and groundwater load imposed, assuming fully deteriorated design conditions.
- B. The CONTRACTOR shall verify pipe size and length prior to manufacture and installation of the liner tube.
- C. The CIPP design shall assume no bonding to the original pipe wall.

#### 2.3. SAFETY

- A. The CONTRACTOR's personnel shall have OSHA confined space entry training. The confined space entry shall be in accordance with the requirements and protocol as specified in 29 CFR 1910.146, Permit Required Confined Spaces, and ASTM D 4276-84.

#### 2.4. TESTING REQUIREMENTS

- A. Chemical Resistance - The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2 and the chemicals listed within Table X2.1. CIPP samples for testing shall be of the tube and resin system similar to that proposed for actual construction. It is required that CIP samples with and without the coating meet these chemical-testing requirements.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. CIPP installation shall be in accordance with ASTM F1216, Section 7, with the following additional requirements:
- B. Each pipeline segment shall be television inspected prior to the installation of the cured-in-place liner. The inspection shall be performed in “dry-pipe” conditions with no flow in the pipe. The pipe shall be clean and free of all obstructions prior to installation of the liner.
- C. Prior to installation of the cured-in-place pipe the CONTRACTOR shall install a hydrophilic rubber gasket on the inside of each pipe where it meets a manhole such that the hydrophilic rubber gasket is between the host pipe and the cured-in-place pipe. The annular space shall be made watertight at the ends of the liner in the manholes.
- A. After the liner has been cured in place, the CONTRACTOR shall reinstate all active service connections as shown on the Drawings. Branch connections to buildings shall be reinstated to a minimum of 95% of the inside diameter of the existing service connection without excavation, utilizing a remotely controlled cutting device, monitored by a video TV camera. No additional payment will be made for excavations for the purpose of reinstating connections and the CONTRACTOR will be responsible for all cost and liability associated with such excavation and restoration work.
- B. Resin Impregnation - 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 migration of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used. To assure thorough wet out, the vacuum application points shall be made, sealed and moved along the length of the liner tube during the impregnation process. A roller system shall be used to uniformly distribute the resin throughout the tube.
- C. The OWNER shall have the right to inspect the wetout operation. The CONTRACTOR shall inform the OWNER 48 hours in advance of wetout.
- D. The installed liner shall be cured by circulating hot water or steam through the resin impregnated tube. Ambient curing shall not be allowed. Curing and cool down of the liner shall be in strict accordance with the manufacturers recommendations. CONTRACTOR is responsible for infiltration/groundwater control. Curing process should account for extraneous infiltration. CONTRACTOR is responsible for any lining defects attributed to insufficient curing due to infiltration.
- E. Temperature gauges / thermocouples shall be placed to determine the temperature of the incoming and outgoing water/steam from the heat source. Another such gauge

shall be placed in the interior and at the bottom of the tube at the remote end to determine the temperature at those locations during the cure cycle.

- F. The CONTRACTOR shall meter and pay for all water used from the water supply. The approval, assistance, and supervision of the local Water Department shall be obtained prior to any such use. When hydrants are to be operated, the CONTRACTOR shall contact the Water District and inform the Water District of the CONTRACTOR's intentions to use and meter water. The CONTRACTOR shall take precaution to prevent any damage to either the hydrant or the main. If directed to operate hydrants, a proper hydrant wrench shall be used for opening and closing the hydrants. Any damage to any part of the water system resulting from misuse by the CONTRACTOR's employees or subcontractors shall be repaired at the CONTRACTOR's expense. The CONTRACTOR shall use water efficiently and avoid waste.
- G. If potable water is utilized in conjunction with pipe lining equipment, the supply lines from hydrants, or other sources, shall be equipped with a suitable backflow prevention device to ensure against pollution of portable water in the event that a negative (suction) head develops.
- H. Discharge of heated water used for curing process shall be in accordance with MWRA Sewer Use Regulations 360 CMR 10.021-10.02. CONTRACTOR is responsible for all costs associated with MWRA discharge requirements for the CIPP liner.
- I. No water used for curing and/or lining activities shall be discharged to the drain. All water used for curing/lining activities shall be discharged in accordance with MWRA requirements.
- J. Reinstatement of Service Connections - After the new pipe has been cured in place, the CONTRACTOR shall reopen the existing service connections as designated on the Drawings and by the OWNER. If the OWNER does not so designate, the CONTRACTOR shall reinstate all connections. It is the intent of these specifications that this shall be done without excavation, and in the case of non-man entry pipes, from the interior of the pipeline by means of a remotely controlled cutting device monitored by a television camera. No additional payment will be made for excavations for the purpose of reopening connections and the CONTRACTOR shall be responsible for all costs and liability associated with such excavation and restoration Work.
- K. All reinstated service connections shall be sealed in accordance with SECTION 02765 – LATERAL CONNECTION REPAIR (LCR). The CONTRACTOR shall make certain that the annular space between the host pipe and the cured-in-place pipe is fully sealed.

### 3.2 INSTALLATION RESPONSIBILITIES FOR INCIDENTAL ITEMS



- A. It shall be the responsibility of the CONTRACTOR to confirm location of all designated manhole access points that shall be open and accessible for the Work and provide rights of access to these points. If a street must be closed to traffic because of the orientation of the sewer, the OWNER shall institute the actions necessary to do this for the mutually agreed time period. The CONTRACTOR shall provide traffic management plan and neighborhood communication plan for OWNER's review prior to commencement of Work.
- B. Line Obstructions - It shall be the responsibility of the CONTRACTOR to clear the line of obstructions such as solids, protruding reinforcement and roots that will prevent the insertion of CIP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the insertion process, and it can not be removed by conventional sewer cleaning, cutting, or grinder equipment, then the CONTRACTOR shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the OWNER's representative prior to the commencement of the Work and shall be considered as a separate pay item.
- C. The CONTRACTOR shall make every effort to maintain service usage throughout the duration of the project. In the event that a service will be temporarily out of service, the maximum amount of time of no service shall be 18 hours for any property served by the sewer. The CONTRACTOR shall be required to notify the OWNER and all affected properties whose service laterals will be out of commission and to advise against water usage until the sewer main is back in service. Such notification shall be provided to the OWNER at least one week prior to service disconnecting.
- D. Public Notification – If work is conducted on a public sewer, 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. CONTRACTOR shall notify residents/property owners of each section that their service will be disrupted a MINIMUM of FORTY-EIGHT (48) hours in advance.

The CONTRACTOR shall also provide the following:

1. Written notice to be delivered to each home or business describing the Work, schedule, how it affects them, and a local telephone number of the CONTRACTOR they can call to discuss the project or any problems that could arise.
2. Personal contact and attempted written notice the day prior to the beginning of Work being conducted on the section relative to the residents affected.
3. Personal contact with any home or business that cannot be reconnected within the time stated in the written notice.

- E. The CONTRACTOR shall be responsible for confirming the locations of service connections. The OWNER will dictate whether or not service connections will be reinstated. The OWNER will provide written authorization of service connections to be reinstated. If no such direction is provided, visibly uncapped services will be reinstated.

### 3.3 INSPECTION AND TESTING

- A. For each inversion length installed, the CONTRACTOR shall prepare one CIPP sample. The flexural strength and modulus test results of the cured liner shall meet or exceed the values required by the approved design submittal and the wall thickness of the cured liner shall be at least equal to that required in the approved design submittal.
- B. An independent testing laboratory shall test the cured-in-place pipe samples and the results are to be sent directly to the ENGINEER within 21 calendar days following the completion of each inversion.
- C. The cost of obtaining and testing the samples, and transmitting testing results shall be the sole responsibility of the CONTRACTOR and shall be considered incidental to the lining process.
- D. Inversions where the cured-in-place pipe samples that do not meet the requirements of ASTM D790 and D638 as indicated in ASTM F1216 Section 8 will be televised by the CONTRACTOR at no additional cost to the Owner, for review by the ENGINEER. Liner deemed unacceptable by the ENGINEER will be removed and replaced at no additional cost to the Owner.
- E. Each sewer segment shall be television inspected after the liner installation has been completed. The inspection shall be performed in “dry-pipe” conditions with no flow in the pipe. Post rehabilitation television inspection shall be performed prior to removing any sewer bypass equipment. Post rehabilitation television inspection shall be considered incidental to the lining process and shall not be measured separately for payment.
- F. Two (2) copies of the closed circuit television video shall be provided to the ENGINEER on DVD.

### 3.4 WARRANTY TESTING

- A. Prior to the expiration of the warranty period during a period of high groundwater as determined by the ENGINEER, 100% of all CIPP shall be inspected in accordance with Section 02440 – PIPELINE CLEANING AND INSPECTION prior to final payment.
- B. Finished pipe shall be continuous through the entire length between manholes, true to line and grade, with no visual bulges, sags, protrusions, deflections, offset joints, leaking joints, wrinkles, dry spots, or other visible infiltration, or other defects that

would impair the intended use of the completed pipeline. The CONTRACTOR shall repair any defects found in the cured-in-place pipe liner.

- C. Final acceptance of rehabilitation Work shall not be granted until all defective areas are repaired to the ENGINEER's satisfaction. All inspection and repair of defects within the warranty period shall be provided at no cost to the OWNER.

### 3.5 CLEAN-UP

- A. 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 02764

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## SECTION 02765

### LATERAL CONNECTION REPAIR (LCR)

#### PART 1 - GENERAL

##### 1.1. SUMMARY

- A. The scope of Work includes rehabilitation and reconnection of service lateral connections to rehabilitated sewer lines, without excavation, by installation and curing of a resin-impregnated, flexible insert that will be installed into the existing service lateral utilizing a pressure apparatus and curing device positioned in the mainline pipe.

##### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of DIVISION 0 - BIDDING AND CONTRACT REQUIREMENTS and other DIVISION 1 Specification Sections, apply to this section.
- B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.
- C. The following items of related work are specified and included in other Sections of the Specifications:
  - 1. Section 02440 – SEWER CLEANING AND INSPECTION
  - 2. Section 02538 – TEMPORARY BY-PASS SEWAGE PUMPING
  - 3. Section 02764 – CURED-IN-PLACE PIPE (CIPP)

##### 1.3 REFERENCES

- A. This specification references the American Society for Testing and Materials (ASTM) standards that are made part hereof by reference and shall be the latest edition and revision.
  - 1. ASTM D160 - Abbreviations of Terms Relating to Plastics
  - 2. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
  - 3. ASTM D578 - Standard Specifications for Glass Fiber Strands
  - 4. ASTM D790 - Test Methods for Flexural Properties of Un-Reinforced and Reinforced Plastics and Electrical Insulating Materials, and

5. ASTM D2990 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
6. ASTM D3681- Standard Test Method for Chemical Resistance of “Fiberglass” (Glass–Fiber–Reinforced Thermosetting-Resin) Pipe in a Deflected Condition
7. ASTM D5813 - Cured-in-Place Thermosetting Resin Sewer Pipe
8. ASTM F1216 - Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
9. ASTM F1743 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
10. ASTM F2561 - Standard Practice for Rehabilitation of a Sewer Service Lateral and its Connection to the Main Using a One-Piece Main and Lateral Cured-in Place Liner
11. Reference is further made to NASSCO Standard: Recommended Specifications for Sewer Collection Systems Rehabilitation.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 - Quality Assurance, and as specified.
- B. The CONTRACTOR and manufacturer (if different) shall ensure that the scope of Work is fulfilled and meets a level of quality of products, materials and workmanship that is commercially available. The manufacturer and the CONTRACTOR shall establish quality assurance requirements similar to ISO 9000 quality standards as a minimum. The CONTRACTOR shall permit the OWNER access to any portion of the manufacturing process and/or installation activities at the request of the OWNER to ensure that the qualities of the materials and/or service are satisfactory.

#### 1.5 SUBMITTALS

- A. The CONTRACTOR is required to provide the following documentation as a minimum:
  1. CONTRACTOR experience – The CONTRACTOR shall provide evidence of previous installations of the product bid for this project. Contact names and telephone numbers shall be provided for the five (5) most recent projects to verify the CONTRACTOR’s experience level.
  2. Description of materials and installation process, including bypass pumping plan.

3. Third party testing and verification of design approach. This data shall verify that the design format utilized by the CONTRACTOR has been independently reviewed and verified.
4. Long-term creep data (50 years), including third party verification. This data shall include the long-term results of the product bid for this project. The long term physical properties of the CIP as determined via this testing cannot be exceeded in the design calculations utilized to calculate the Liner wall thickness.
5. Proposed flexural modulus

## 1.6 WARRANTY

- A. If, within the warranty period, the Liner installed in the sewer system is not acceptable due to leakage or any other defects, although originally accepted, the contractor shall repair or replace the affected portion at no cost to the Town. It is understood that if the contractor fails to do such work as required, the contractor shall be responsible for said costs of repair or replacement.
- B. The CONTRACTOR shall make all necessary repairs and replacements to remedy, in a manner mutually agreed, and at no cost to the OWNER, of any and all defects, breaks, or failures of the Work occurring within one (1) year following the date of acceptance of the Work due to faulty or inadequate materials or workmanship.

## 1.7 SAFETY

- A. The CONTRACTOR's personnel shall have OSHA confined space entry training. The confined space entry shall be in accordance with the requirements and protocol as specified in 29 CFR 1910.146, Permit Required Confined Spaces, and ASTM D 4276-84.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. Service lateral connections may be a combination of tee's, wye's or break-in taps of varying sized and angle from 30 to 90 degrees and may include over-cut lateral openings, pilot holes or defects in relined sewer pipe.
- B. The resin shall be rapidly cured to transform the flexible insert into a hard, impermeable seal around the main pipe and in the lateral connection. The Liner shall extend from the mainline into the lateral connection in a continuous tight fitting, watertight pipe-within-a-pipe to eliminate any visible ground water leakage and future root growth at the lateral to mainline connection..

- C. The finished CIP Lateral Liner shall have a one piece 360 degree full wrap main CIP Liner with an integral lateral connection CIP Liner that extends into the lateral a maximum of 24 inches.
- D. The CIPP lateral and lateral-to-main connection Liner repair system shall be as manufactured by Trelleborg – EPROS; Liner Products LLC; BLD “Service Connection Seal + Lateral” of BLD Services, LLC; or approved equal.
- E. The rehabilitation shall be accomplished using a non-woven textile tube of particular length and a thermo-set resin with physical and chemical properties appropriate for the application. The lateral tube located within an inversion bladder is impregnated with the resin and is then placed inside of a protective carrying device.
- F. The mainline portion of the Liner is physically attached to the lateral portion and is affixed around a launching device. When the launching device is properly positioned at the lateral connection, the mainline bladder is inflated by pressurized air that presses the main Liner against the host pipe. The lateral portion is then inverted up through the service lateral by the action of the inversion bladder. Once the resin-saturated Liner is cured, the inversion bladder and launching/carrying devices are removed.
- G. Curing:
1. In most circumstances, an accelerated ambient-temperature curing resin system will be utilized. If a heat cure is required, the Contractor shall supply a suitable heat source and recirculation equipment. The equipment shall be capable of delivering the approved heating medium throughout the section to the temperature required to affect a cure of the resin. This temperature shall be determined by the resin/catalyst system employed.
  2. If a heat cure is required, the heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing air/steam or water supply.
  3. Initial cure shall be deemed to be completed when inspection of the exposed portions of the CIPP appears to be hard and sound and/or the temperature gauge indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the installation process.
  4. Cool-down: The Contractor shall cool the hardened CIPP to a temperature below 100°F before relieving the pressure in the pressure apparatus. Care shall be taken to maintain proper pressure throughout the cure and cool-down period.
- H. Material:
1. Materials as specified by NASSCO Standard Specifications for CIP lateral lining.
  2. The Liner assembly shall be continuous in length and consist of one or more layers of absorbent textile material that meets the requirements of ASTM F1216 and



ASTM 05813. The textile shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe segments, and flexibility to fit irregular pipe sections.

3. The wet-out textile shall meet ASTM F1216 and shall have uniform thickness and 5% to 10% excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.
4. The mainsheet and lateral tube shall be a one-piece assembly formed in the shape of a "T" or WYE. No intermediate or encapsulated elastomeric layers shall be in the textile that may cause de-lamination in the cured in place pipe.
5. The lateral tube will be capable of conforming to offset joints, bells, and disfigured pipe sections.

I. Resin System:

1. The resin/liner system shall conform to ASTM D5813 Section 8.2.2 - 10,000-hour test.
2. The resin shall be a corrosion resistant polyester, vinyl ester, epoxy or silicate resin and catalyst system that when properly cured within the composite liner assembly, meets the requirements of ASTM F1216, the physical properties herein, and those which are to be utilized in the design of the CIPP, for this project.
3. The finished Liner shall be chemically resistant to domestic sewage over the expected lifetime of the rehabilitated pipe.
4. The Liner shall be compatible with the lining system utilized for the main and/or lateral sewer lines.

2.2 STRUCTURAL REQUIREMENTS

- A. The CIP shall be designated as per ASTM F1216, designed to have sufficient strength to handle dead loads, live loads, and groundwater load imposed, assuming fully deteriorated host pipe conditions.
- B. The cured Liner shall conform to the minimum standard listed below:
  1. Flexural Modulus of Elasticity: ASTM D790; 250,000 psi minimum
  2. Flexural Strength: ASTM D790; 4,500 psi minimum
- C. Refer to Section 02764 – CURED-IN-PLACE PIPE (CIPP) for further requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to installing the CIPP Liner, the area around the lateral sealing surface in both the main and lateral shall be inspected. Waste product build-up, hard scale, roots, lateral cutting debris or resin slugs must be removed using high-pressure water jetting or in-line cutters.
- B. Break-in connection and/or lateral pipe protruding into the mains shall be ground back to no more than a 1/8-inch protrusion into the mainline.
- C. Built-up deposits on the main and lateral pipe walls shall be removed. The removal shall reach at least one foot beyond the Liner to allow the bladder to inflate tightly against the pipe walls ensuring a smooth transition from Liner to the existing pipe wall.
- D. In relined pipes, the lateral must be opened 95 percent or more and edges finished without "teeth". Over-cuts shall not exceed one inch beyond the internal diameter of the lateral.
- E. The contractor shall be responsible for bypassing of sewage during the installation of the Liner, if needed.

### 3.2. SERVICE LATERAL CONNECTIONS

- A. The resin impregnated Liner shall be loaded on the applicator apparatus, attached to a robotic device and positioned in the mainline pipe at the service lateral connection that is to be rehabilitated. The robotic device together with a video camera shall be used to align the LINER repair product with the service connection opening. Air pressure, supplied to the applicator through an air hose, shall be used to insert the resin impregnated Liner into the lateral pipe. The inserted Liner will then be inspected using a video camera to confirm the Liner is correctly positioned and centered in the service lateral opening prior to curing. The insertion pressure will be adjusted to fully deploy the Liner into the lateral connection and hold the Liner tight to the main and lateral pipe walls.
- B. The pressure apparatus shall include a bladder of sufficient length in both the main and lateral lines such that the inflated bladder extends beyond the ends of both the lateral tube and main line segments of the Liner, pressing the end edges flat against the internal pipe wall and forming a smooth transition from the Liner to pipe diameters without a step, ridge or gap between the Liner and the inner diameters of the lateral and mainline pipes.
- C. After insertion is completed, recommended pressure must be maintained on the impregnated Liner for the duration of the curing process.
- D. The packer is then deflated, removed from connection and returned to the manhole to repeat the cycle.
- E. The finished Liner shall be free of dry spots, lifts and delamination. The installed Liner should not inhibit the post installation video inspection, using a closed circuit television camera, of the mainline and service lateral pipes or future pipe cleaning operations.

- F. After the work is completed, the contractor will provide the Town with an electronic photographs and recorded data identifying the location and showing the completed work and restored condition of all the rehabilitated service lateral connections.
- G. During the warranty period, any defects with the Liner that affect the performance or cleaning of the lateral connection shall be repaired at the CONTRACTOR'S expense in a manner acceptable to the OWNER.

### 3.3. INSTALLATION RESPONSIBILITIES FOR INCIDENTAL ITEMS

- A. It shall be the responsibility of the CONTRACTOR to confirm the location of all designated manhole access points that shall be open and accessible for the Work and provide rights of access to these points. If a street must be closed to traffic because of the orientation of the sewer, the OWNER shall institute the actions necessary to do this for the mutually agreed time period. The CONTRACTOR shall provide a traffic management plan and neighborhood communication plan for OWNER's review prior to commencement of Work.
- B. Line Obstructions - It shall be the responsibility of the CONTRACTOR to clear the line of obstructions such as solids, protruding reinforcement and roots that will prevent the insertion of CIP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the insertion process, and it cannot be removed by conventional sewer cleaning, cutting, or grinder equipment, then the CONTRACTOR shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the OWNER's representative prior to the commencement of the Work and shall be considered as a separate pay item.
- C. The CONTRACTOR shall make every effort to maintain service usage throughout the duration of the project. In the event that a service will be temporarily out of service, the maximum amount of time of no service shall be 18 hours for any property served by the sewer. The CONTRACTOR shall be required to notify the OWNER and all affected properties whose service laterals will be out of commission and to advise against water usage until the sewer main is back in service. Such notification shall be provided to the OWNER at least one week prior to service disconnecting.
- D. The CONTRACTOR shall also provide the following:
  - 1. Written notice to be delivered to each home or business describing the Work, schedule, how it affects them, and a local telephone number of the CONTRACTOR they can call to discuss the project or any problems that could arise.
  - 2. Personal contact and attempted written notice the day prior to the beginning of Work being conducted on the section relative to the residents affected.
  - 3. Personal contact with any home or business that cannot be reconnected within the time stated in the written notice.

- E. The CONTRACTOR shall be responsible for confirming the locations of service connections. The OWNER will dictate whether or not service connections will be reinstated. The OWNER will provide written authorization of service connections to be reinstated. If no such direction is provided, visibly uncapped services will be reinstated.

#### 3.4. WARRANTY TESTING

- A. Prior to the expiration of the warranty period during a period of high groundwater as determined by the ENGINEER, 100% of all Service Lateral Liners shall be inspected prior to final payment.
- B. Finished pipe shall be continuous through the applied areas, true to line and grade, with no visual bulges, sags, protrusions, deflections, offset joints, leaking joints, wrinkles, dry spots, or other visible infiltration, or other defects that would impair the intended use of the completed pipeline.
- C. Any repairs necessary, as determined by the ENGINEER, as a result of this inspection shall be performed by the CONTRACTOR.
- D. Final acceptance of rehabilitation Work shall not be granted until all defective areas are repaired to the ENGINEER's satisfaction.

#### 3.5. CLEAN-UP

- A. Upon acceptance of the 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 02765