SECTION 06015 – POLYVINYL CHLORIDE (PVC) EXPANDED IN-PLACE PIPE (EIPP)

PART 1 - GENERAL

1.01 SUMMARY

The work specified under this section provides for the rehabilitation of an existing gravity line or conduit using PVC expanded in-place pipe (EIPP) trenchless technology. The process consists of installing a PVC pipe liner inside an existing gravity line (host pipe) from structure to structure. When installed, the liner shall be a seamless, joint-less, solid wall PVC pipe liner tightly conformed to the interior of the host pipe. The seamless, joint-less liner shall be continuous from structure to structure with the active service connections re-established using closed circuit television (CCTV) and remotely controlled cutters. Neither the PVC EIPP liner system selected by the Contractor, nor its installation, shall cause adverse effects to any of the City's processes or facilities.

1.02 SPECIFICATION MODIFICATIONS

A. It is understood that throughout this section these Specifications may be modified by appropriate items in Section 01015 – Specific Project Requirements or as indicated in the Contract Drawings.

1.03 RELATED SECTIONS

A. Section 01000 – General Project Requirements.
B. Section 01015 – Specific Project Requirements.
C. Section 01270 – Adjustment Unit Prices and Measurement Procedures.
D. Section 01300 – Submittals.
E. Section 01500 – Temporary Facilities.
F. Section 01566 – Cleanup Operations.
G. Section 01700 – Traffic Control.
H. Section 02503 – Sewer Mainline Open-Cut Point Repair.
I. Section 02505 – Sanitary Sewer Service Lines and Connections.
J. Section 02686 – Cleaning and Assessment of Gravity Lines.
K. Section 06010 – Cured-In-Place Pipe (CIPP), CIPP Point Repairs and End Seals.
L. Section 06012 – Rehabilitation of Sewer Laterals and Sewer Lateral Connections.

1.04 CODES AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
B. American Society for Testing and Materials (ASTM):

ASTM D638	Standard Test Method for Tensile Properties of Plastics.
ASTM D790	Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Material.
ASTM D1784	Standard Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
ASTM F1504	Standard Specification for Folded/Formed Poly Vinyl Chloride (PVC) Pipe for Existing Sewer and Conduit Rehabilitation.

ASTM F1947	Standard Practice for Installation of Folded/Formed Polyvinyl Chloride (PVC) Pipe for Existing Sewer and Conduit Rehabilitation.
ASTM F2122	Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

1.05 DEFINTITIONS

A. Not used.

1.06 INFORMATION PROVIDED BY THE CITY

A. As provided in the Contract Documents.

1.07 SUBMITTALS

A. Submit as specified in Section 01300 – Submittals.
B. Product Data:
   1. Design approach and formula(s).
   2. Diameter, length and wall thickness for each segment of gravity line.
   3. Fittings and adapters.
   4. Method and material of sealing liner at structures.
   5. Manufacturer's storage and handling requirements.
   6. Chemical and Physical Test Results conducted by a 3rd Party. Testing results shall be conducted within 24 months of submittal.
C. Tests Reports:
   1. Certified reports and logs of all tests and inspections. Tests shall be completed in the past 2 years.
D. Certificates, Affidavits and Qualifications.

1.08 INSTALLER QUALIFICATIONS

A. The Installer and its key field installation personnel scheduled for the project shall have experience within the last five (5) years, from the date of submittal, with the installation of PVC EIPP liner as specified herein:
   1. The Contractor shall provide a minimum of five (5) references for projects that the installer and key personnel have completed at least 20,000 linear feet of expand in-place PVC liner in diameters ranging from 8 to 42 inches in diameter. If the expand in-place PVC liner is specified for pipes larger than 42 inches in diameter for the Work, the Installer's references shall include experience with like diameters. These project references shall include the name and telephone number of the contact person who has direct knowledge of the performance of the Installer. The reference must indicate an acceptable performance by the Installer.
   2. Resumes of key field installation personnel (superintendent, foreman, cutter operator) shall be submitted to the City/Design Professional. All changes of key personnel during the execution of the Project requires submittal of the resumes for the personnel to be substituted.

1.09 QUALITY ASSURANCE

A. The Contractor is responsible for the quality assurance and quality control of the Work.
B. Furnish the following prior to shipment or installation as applicable:
   1. Affidavit of compliance with applicable standards for PVC liner materials.

2. Certification sealed by an insured registered professional engineer that the liner design and thickness meet the minimum structural design criteria specified herein or as otherwise required by the project.

C. Furnish the following after installation and testing:
   1. Affidavit of compliance for leak test of lined pipe.
   2. Affidavit of compliance for minimum liner thickness.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and storage of lining and other materials shall conform to requirements of the manufacturer.
B. Contractor shall furnish required storage facilities.
C. Handle lining materials in compliance with the manufacturer's recommendations.
D. Damaged material, as determined by the City/Design Professional, is unacceptable for installation.

PART 2 - PRODUCTS

2.01 STRUCTURAL REQUIREMENTS

A. The liner shall be designed in accordance with ASTM F1504. The design shall be based on a fully deteriorated pipe condition and shall be designed to withstand the structural requirements within this specification and designed for a minimum service life of not less than 50 years.
B. The Manufacturer and Contractor shall certify and provide structural calculations that the product at the installed thickness will adequately support all loads.
C. Minimum Structural Standards. The installed PVC liner material shall conform to the following minimum structural standards per ASTM D638, D648 and D790:

Tensile Strength	Test Method D638	6,000psi
Tensile Modulus	Test Method D638	320,000psi
Flexural Strength	Test Method D790	6,000psi
Flexural Modulus	Test Method D790	320,000psi
Heat Deflection Temperature	Test Method D648	158°F Tested @ 264psi

D. Pipe Flattening. There shall be no evidence of splitting, cracking or breaking when the rounded pipe is tested according to section 11.3 of ASTM F1504.
E. Pipe Impact Strength. The impact strength of rounded pipe shall not be less than the values listed in Table 1. when tested in accordance with test method D2444 as referenced in ASTM F1504.

Table 1. Minimum Impact Strength at 73°F (23°C)

Pipe size, in. (mm)	Impact strength, ft-lb f (J)
6 (150)	210 (284)
8 (200)	210 (284)
10 (250)	220 (299)
12 (300)	220 (299)
15 (375)	220 (299)
18 (450)	220 (299)
24 (600)	220 (299)
30 (750)	220 (299)

F. Pipe Stiffness. Values for pipe stiffness for the rounded pipe shall comply with Table 2 on the following page when tested in accordance with test method D2412 as referenced in ASTM F1504.

Table 2. Minimum Pipe Stiffness at 5% Deflection

Pipe Size, in. (mm)	Pipe Stiffness, psi (kPa)	Dimension Ratio, (DR)
6 (150)	36 (250)	35
8 (200)	36 (250)	35
10 (250)	36 (250)	35
12 (300)	22 (153)	41
15 (375)	12 (83)	50
18 (450)	6 (41)	66
24 (600)	6 (41)	66
30 (750)	6 (41)	66

G. Extrusion Quality. The extrusion quality of the pipe shall be evaluated by both of the following test methods:
   1. Acetone Immersion**:** The pipe shall not flake or disintegrate when tested in accordance with test method D2152 as referenced in ASTM F1504.
   2. Heat Reversion**:** The extrusion quality of the pipe shall be estimated by heat reversion method in accordance with practice F1057 as referenced in ASTM F1504.
   3. Flexural Properties: The flexural strength and modulus of the pipe shall be tested in accordance with test method D790 as referenced in ASTM F1504.

H. Dimensions:
   1. Formed Pipe Diameter: The average outside diameter of the formed pipe shall meet requirements in Table 3, +/- 1.0% when tested in accordance with test method D2122 as referenced in ASTM F1504.
   2. Formed Pipe Wall Thickness: The wall thickness of the formed pipe shall not be less than the values specified in Table 3. when tested in accordance with test method D2122 as referenced in ASTM F1504.

Table 3. Formed Pipe Dimensions

Nominal Outside Diameter, in. (mm)	Minimum Wall Thickness, in. (mm)	DR
6 (150)	0.17 (4.34)	35
8 (200)	0.23 (5.78)	35
10 (250)	0.28 (7.23)	35
12 (300)	0.292 (7.4)	41
15 (375)	0.30 (7.6)	50
18 (450)	0.27 (6.8)	66
24 (600)	0.34 (8.7)	66
30 (750)	0.43 (10.8)	66

I. The installed PVC liner design assumes no bonding to the original pipe. The required minimum design thickness of each liner wall shall be in accordance with ASTM F1504 with the minimum design parameters listed in Table 4. on the following page.

Table 4. PVC EIPP Minimum Design Parameters

Parameter	Minimum
Mean diameter of original gravity line	As measured
Depth of cover to top of pipe for Dead Load calculation	12.5 feet
Water table below surface	0 feet
Unit weight of soil	130 pcf
Soil Modulus (E')	700 psi
Ovality	2%
Live Load at 8 feet depth of cover	HS-25
Deteriorated Condition	Fully
Factor of Safety	2
Minimum design PVC wall thickness	5.8 mm for 8-inch pipe, 7.3 mm for 10-inch pipe and 7.4 mm for 12-inch pipe

J. The Contractor is required to field verify the mean diameter, minimum diameter and depth of cover of the existing pipeline, prior to ordering the liner material. All measurement information and the calculated liner thickness shall be provided to the City/Design Professional prior to ordering the liner. For diameters not listed in Table 1, based on field conditions, the Contractor may request a Live Load variance (from HS-25 to HS-20) to adjust the calculated PVC liner thickness.

2.02 ADJUST THE DEPTH OF COVER FOR DEAD LOAD CALCULATION IF THE MEASURED DEPTH IS GREATER THAN THE MINIMUM VALUE IN THE TABLE 1. ADJUST LIVE LOAD CALCULATION FOR DEPTH OF COVER LESS THAN 8 FEET

A. PVC liner:
   1. The PVC liner shall meet the requirements of ASTM F1504.
   2. The liner shall be fabricated to a size that when installed will tightly fit the internal circumference and length of the original host pipe. Allowance shall be made for longitudinal and circumferential stretching during the installation process. The minimum length shall be that deemed necessary by the Contractor to effectively span the distance between respective access points without damaging the liner. The Contractor shall measure the lengths and diameters in the field before fabricating the liner. Individual installation runs can be made over one or more structures as determined in the field by the Contractor. The Contractor will be allowed to insert only the length of liner that it can install, expand and place back in service within the allowable working hours. Intermediate structures shall be reopened, unless otherwise directed by the City/Design Professional.
   3. The liner shall have a uniform thickness when expanded at installation pressure.
   4. The wall color of the interior pipe surface of the PVC liner after installation shall be white so that a clear and detailed examination with CCTV inspection equipment may be made.

2.03 CIPP END SEAL (WATERSTOP)

A. See Section 06010 – Cured-In-Place Pipe (CIPP), CIPP Point Repairs and End Seals for requirements.

2.04 PIPE END SEAL LINER

A. See Section 06010 – Cured-In-Place Pipe (CIPP), CIPP Point Repairs and End Seals for requirements.

2.05 CHEMICAL RESISTANCE

A. See Section 06010 – Cured-In-Place Pipe (CIPP), CIPP Point Repairs and End Seals for requirements.

2.06 SEWER LATERALS AND SEWER LATERAL CONNECTIONS

A. See Section 06012 – Rehabilitation of Sewer Laterals and Sewer Lateral Connections for requirements.

2.07 CURED-IN-PLACE-PIPE (CIPP) POINT REPAIR LINER

A. See Section 06010 – Cured-In-Place Pipe (CIPP), CIPP Point Repairs and End Seals for requirements.

2.08 QUALITY CONTROL

A. The Contractor is responsible for the quality assurance and quality control of the Work.

B. The Contractor shall submit samples to an independent laboratory for a report to be developed. Prior to shipping the samples to a laboratory, the Contractor shall obtain approval of the samples to be tested from the City/Design Professional.

C. If the results of the tests do not meet the requirements listed in this specification and ASTM standards, the City may require the Contractor to perform further destructive tests on the liner segment in question; additionally, if the test results do not meet the requirements, the Contractor may be required to install a Type II liner per ASTM D1784. If the additional test results meet the requirements, a sectional point repair shall be made in accordance with Section 06010 – Cured-In-Place Pipe (CIPP), CIPP Point Repairs and End Seals, at each location where destructive samples were obtained. All costs associated with additional testing, Type II liner installation and sectional point repairs shall be at the Contractor's sole expense.

D. Expansion Installation:

1. The Contractor shall inform the City as to the maximum allowable expansion head (pressure) that can be used for expanding the liner into the pipe (as recommended by Manufacturer) without rupturing or diminishing the diameter and/or the thickness of the PVC liner. Such installation pressure shall be monitored at all times during the installation operation and the liner shall be rejected and removed prior to final set if the recommended expansion head force is exceeded. The Contractor shall submit the minimum and maximum expansion pressure required to fully expand the liner against the host pipe.

E. Service Lateral Reinstatement:

1. The PVC liner installer shall determine if a service connection is active prior to rehabilitation of the gravity line. Dye testing, CCTV with a lateral launch camera and all other means shall be used to determine if a connection is active or not. Only active service connections and laterals shall be reinstated. Upon completion of all testing to determine active service connections, Contractor shall review results with the City's representative and obtain concurrence prior to reinstatement.

2. The PVC liner installer shall install a sectional point repair in accordance with Section 06010 – Cured-In-Place Pipe (CIPP), CIPP Point Repairs and End Seals, for any reinstated non-active service connection. If the pipe diameter is greater than eighteen (18) inches, the Contractor shall submit to the City a method of repair for approval. All cost associated with repairs closing non-active service connections shall be at the Contractor's expense.
3. The City may direct the Contractor to complete point repairs of any misaligned active service connection that is opened after PVC liner has been installed. Connections to PVC lined pipe shall be made as shown in drawing 06015-1. This point repair shall be as directed and approved by the City and paid according to the appropriate Adjustment Unit Price.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall comply with the following procedures unless other procedures are approved by the City.
B. Prior to the commencement of the actual liner installation process, the Contractor shall plan its work after review of preliminary CCTV television inspection performed by the contractor. All point repairs shall be satisfactorily completed, equipment and material mobilized; and the City shall be informed on the impending work schedules (see paragraph C. below) for PVC liner installations.
C. General construction sequencing is as follows: cleaning of mainline (see Section 02686 – Cleaning and Assessment of Gravity Lines), CCTV of mainline, all obstructions removed, mainline point repairs made where needed, bypass pumping established, mainline PVC liner installed, laterals reinstated, LCR/MTH's installed (see Section 06012 – Rehabilitation of Sewer Laterals and Sewer Lateral Connections), structures rehabbed and site restored.

3.02 SAFETY

A. The Contractor shall carry out its operations in accordance with all OSHA and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving working with scaffolding and entering confined spaces.
B. The Contractor shall inform City of any hazardous material encountered during this project.
C. Traffic control shall be performed in accordance with Section 01700 – Traffic Control.

3.03 CLEANING OF THE GRAVITY LINE

A. The Contractor shall be required to remove all internal debris from the gravity lines, so the entire pipe can be thoroughly inspected and successfully reconstructed. Pipe to be lined shall be cleared of protruding service connections, debris or other obstructions that could hinder the PVC liner installation. Cleaning shall be performed as specified in Section 02686 – Cleaning and Assessment of Gravity Lines.

3.04 BYPASS PUMPING

A. The Contractor shall provide for the flow of sewage around the section or sections of pipe designated for rehabilitation and inspection and at a cost incidental to the installation of the PVC liner. The bypass shall be made by plugging the line at an existing upstream structure or adjacent system. The

pumping system shall be of adequate capacity and size to handle at least two times the max month flow rate. The contractor shall work with the City/Design Professional to verify flow rates for each section of pipeline to be lined and determining the max month flow rate. The Contractor shall submit a flow control implementation plan for the City's acceptance prior to construction.

B. Bypassing includes all mainline bypassing and service line bypassing, if required.
C. Wastewater shall not be allowed to spill into storm drains, street gutters or open excavations. Any spills that occur must be taken care of properly and immediately. The City shall be immediately notified and the Contractor shall bear all costs associated with any spills from its bypass system.
D. The Contractor shall take all necessary steps to prevent flooding of any residence or business and shall be liable for any damages incurred because of the Contractor's operation.
E. Once liner is completely installed and service connections are reinstated:
   1. Place rehabilitated gravity line sections back in service.
F. All accumulated debris that is built up behind the bypass plug shall be removed in accordance with Section 02686 – Cleaning and Assessment of Gravity Lines.

3.05 CCTV INSPECTIONS

A. CCTV shall be performed as specified in Section 02686 – Cleaning and Assessment of Gravity Lines.
B. The PVC liner installer shall provide inspection of gravity lines by experienced personnel specially trained in locating breaks, obstacles and active service connections by CCTV, as specified in other sections. All inspections shall be in accordance with NASSCO PACP standards.
C. The inspection of pipelines is also to aid in the determination of active service connections and the addresses which they serve.
D. The interior of the gravity line shall be carefully inspected to determine the location of all active lateral connections, the location and extent of any structural failures, pipe deflections, offset joints or other factors that will affect the installation or performance of the PVC liner system.
E. Contractor shall notify City when point repairs are required where existing gravity line sections must be removed or replaced to successfully install the PVC liner.

3.06 LINE OBSTRUCTIONS

A. Obstructions shall be removed in accordance with ASTM 1947 and this Section.
B. It shall be the responsibility of the Contractor to clear the host pipe of obstructions.
C. If pre-installation inspection reveals an obstruction such as solids, roots, a protruding service connection, dropped joint, excessively deformed section, mineral deposits or a collapse that will prevent the liner installation process and it cannot be removed by conventional cleaning equipment, then the Contractor will notify the City and Contractor shall make a point repair excavation to uncover and remove or repair the obstruction:
   1. Such excavation shall be approved in writing by the City prior to the commencement of the work and shall be considered as a separate pay item as provided in the Bid Schedule.
   2. Where sections of the existing gravity line must be removed (open cut point repair), the repair shall be done in accordance with Section 02503 – Sewer Mainline Open-Cut Point Repair.

3. When a collapsed or protruding sanitary sewer service connection point must be removed (open cut repair), the repair shall be done in accordance with Section 02505 – Sanitary Sewer Service Lines and Connections.
4. This work shall be performed by the Contractor as recommended by the PVC liner manufacturer and as directed by the City.

3.07 EXISTING VOIDS

A. Field locate and record all voids and holes to be filled. Record shall include the following dimensions and measurements:
   1. Distance from both upstream and downstream structures to each void or hole.
   2. Length, width and depth of each void or hole, such that approximate volume of fill material may be calculated.
   3. Location of each void or hole in the gravity line crown stated in clock position as viewed from downstream.
B. Prior to installation of the PVC liner, submit recommendations for filling voids, including those to be filled after installation of the liner. The City will issue a Request for Proposal and after acceptance of the Contractor's proposal, a Work Change Directive and Change Order will be issued for performance of the required Work.
C. Fill all voids or holes recorded. All large voids or holes shall be filled with concrete, non-shrink grout or other material. Voids and holes below the centerline elevation of the existing gravity line shall be filled prior to installation of the liner. Voids and holes above the centerline elevation of the existing gravity line may be filled after installation of the liner. Perform in a manner to ensure that voids and holes are filled. Plug any holes in the liner wall with a manufacturer's approved method. Submit documentation of manufacturer's approved method of plugging holes.

3.08 PUBLIC COMMUNICATIONS

A. Notification of affected property owners shall be in accordance with Section 01581 – Public Communications.
B. Contact any home or business which cannot be reconnected within the time stated in the written notice.

3.09 TEMPORARY FACILITIES

A. See Section 01500 – Temporary Facilities.

3.10 PVC LINER INSTALLATION

A. PVC liner installation shall be in accordance with ASTM F1947, with the following additional requirements:
   1. Immediately prior to installing the liner, the contractor will completely flush and televise the pipeline for inspection by the City representative to ensure a clean, debris free pipeline.
   2. Pre Heating. Prior to insertion of the liner into the host pipe the Contractor shall pre-heat the liner in the manner proscribed by the manufacturer's installation instructions. The heated liner must be pliable enough to be pulled into the host pipe with as little resistance as possible.
   3. Pipe Liner Insertion. The liner pipe shall be inserted into the gravity line through existing structures, without modification of the structures. Insertion of the liner into the host pipe will be accomplished by pulling the liner into the host pipe by means of a steel cable strung through the host pipe from a winch located at the

downstream structure. The end of the liner shall be prepared for attachment to the cable in accordance with the manufacturer's instructions. The connection between the pulling cable and the prepared end of the liner shall be a swivel device to prevent twisting of the liner as it is pulled through the host pipe. The heated liner coil shall be placed in such a manner as to prevent damage to the liner as it is pulled through the structure and into the host pipe. A member of the installation crew at the upstream end shall monitor the speed of the pull; he must coordinate the speed of the pull with the winch operator at the downstream structure via two-way radio. The crewmember coordinating the insertion of the liner shall ensure that the liner has the proper amount of slack, to prevent it from being either stretched or kinked.

4. Stress Relief. After the liner has been inserted into the host pipe, the Contractor shall relieve any stress imparted to the liner during the insertion in a manner prescribed in the manufacturer's installation instructions.
5. Processing:
   (a) The Contractor shall supply suitable heat source equipment. The equipment shall be capable of delivering steam through the lining section to uniformly raise the temperature of the PVC material to effect forming of the liner pipe.
   (b) Suitable monitors shall be installed to gauge steam temperatures and pressures at the input and exhaust ends of the liner. Steam monitoring methods and forming period shall be recommended by the liner manufacturer.
      i. The pressure shall be maintained between the manufacturer's minimum and maximum pressures until the operation has been completed. Should the pressure deviate substantially from within the range of minimum and maximum pressures, the installed liner may be tested to determine if it meets the contract requirements. If it fails to meet the contract requirements, the Contractor shall make repairs as described in paragraph QUALITY CONTROL.
      ii. Contractor shall continuously monitor and record pressure during the installation process. A complete log of the pressures and temperatures shall be maintained on the site and shall be furnished to the City after each installation.
      iii. The City representative may also monitor the installation of the liner to verify general compliance with the recommended manufacturers cure schedule.
   (c) After forming, the liner shall be cooled using compressed air or a mixture of compressed air and water. Cooling shall be deemed complete when the temperature of the exhaust air or air water mixture has remained constantly below 110ºF for a minimum of 10 minutes.
6. Trimming:
   (a) After installation, the ends of the PVC liner shall be cut off in the structure. The cuts shall be smooth and parallel with the structure wall. The finished liner shall not protrude into the structure over 4 inches.
   (b) If the structure has been lined through, the top half of the liner pipe may be cut off even with the top of the shelf, leaving the channel lined.

3.11 SEALING PVC LINER AT STRUCTURES

A. The liner shall extend a minimum of 2 to 3 inches into the structure.
B. Prior to PVC Liner installation, the Contractor shall install end seals (waterstops) to the interior circumference of the existing gravity line at each end of the PVC liner per manufacturer's recommendations. When the liner is pulled through a structure

during installation, ends seals shall also be placed on both sides of the structure. No separate payment for end seals shall be made.

C. The invert of the structure shall be reworked (smoothed and built up) to match the flow line of the new PVC liner. Submit methods and materials for approval before installation.

D. If the installed PVC liner fails to make a tight seal, the Contractor shall apply a sealant.
   1. The sealant shall be compatible with all materials used in the lining process and shall be as recommended by the manufacturer of the PVC liner.

3.12 SERVICE CONNECTIONS

A. After installation of the PVC liner has been completed and after the pressure test specified herein, the Contractor shall only reinstate existing active service connections and branch connections.

B. It is the intent of these specifications that active service connections and branch connections be reopened without excavation and in the case of non-man entry pipes, from the interior of the pipeline utilizing a remotely controlled cutting device, monitored by a closed-circuit television camera, which fully opens the service connections. Reinstatement of lateral service shall provide a full diameter hole, free from burrs or projections and finished with a smooth edge.

C. The Contractor shall certify he has a minimum of two (2) complete working lateral cutter systems, plus spare key components on the site before each PVC liner installation.

D. If the lateral cutter systems are not functional, no additional payment will be made for excavations for reinstating service connections and the Contractor will be responsible for all costs and liability associated with such excavation and restoration.

E. All active service laterals shall be reinstated within 8 hours of beginning the installation process unless a written plan is submitted by the contractor and approved by City prior to the installation process.
   1. Contractor shall provide temporary facilities or hotel accommodations for the residents if sewer service is not restored within 8 hours.

3.13 INSPECTION

A. Visual Inspection:
   1. Visual inspection of the PVC liner shall be in accordance with ASTM F1947.
   2. All defects discovered during the post liner CCTV inspection shall be corrected by the Contractor at the Contractor's expense before the work will be considered complete by the City. Defects include any wrinkles in the finished liner greater than one-half (1/2) inch or the results in reduction of pipeline hydraulic capacity. If directed by the City, Contractor shall remove the wrinkle and install a sectional point repair in accordance with this Section, paragraph 2.07 and 3.16, at no additional cost to the City.
   3. Pinholes in the PVC liner are not allowed and the installed PVC liner shall be rejected. All observed pinholes shall be addressed and repaired by the Contractor at no additional cost to the City.
   4. The post-construction CCTV data shall be conducted once all work in a line segment is complete (main line, point repairs, laterals and structure rehabilitation).
   5. Direct flow around sections being televised using the same method required for installation.

3.14 PIPE END SEAL LINER

A. Install per Section 06010 – Cured-In-Place Pipe (CIPP), CIPP Point Repairs and End Seals.

3.15 FIELD QUALITY CONTROL

A. Finish:
   1. The finished PVC liner shall be continuous over the entire length of an installation between two structures and shall be free from all defects. It shall also meet the leakage/pressure test requirements specified herein.
   2. Any defects which will affect the integrity or strength of the PVC liner shall be repaired at the Contractor's expense, in a manner recommended by the manufacturer and mutually agreed upon by the City and the Contractor.

B. Sampling:
   1. Samples should be obtained from every liner section installed in accordance with ASTM F1947.
   2. For each insertion length, a rounded field sample shall be prepared at the insertion and termination point by installing the folded PVC pipe into a mold pipe. The mold pipe shall be of like diameter to the existing pipe and should be a minimum of one diameter in length. The test procedures shall be followed after the sample is expanded and cooled down as an integral part of the EIPP installation process and removed from the mold pipe.
   3. A unique identification number shall be marked on the outside of each sample.
   4. The labeled sample shall then submitted for testing at the Contractor's expense.
   5. Failure to meet or exceed any of the requirements of this specification based on the design parameters outlined in the Construction Contract Documents shall be cause for rejection.
   6. The Contractor shall retain all samples not selected for testing until completion and acceptance of all Work. All samples shall then be turned over to the City, unless otherwise directed.

C. Material Testing:
   1. PVC liner samples shall be tested in accordance with ASTM F1504. The following tests shall be performed by a 3rd Party Certified Independent laboratory, approved by the City at the Contractor's sole expense:
      (a) Short-Term Flexural (Bending) Properties in accordance with ASTM F790.
      (b) Tensile Properties Tests shall be performed in accordance with ASTM D638.
      (c) PVC Liner Thickness Tests shall be performed in accordance with ASTM D1784. The average thickness of the installed PVC liner shall meet or exceed the minimum design thickness. The minimum installed wall thickness at any point shall not be less than 99% of the specified design thickness.
      (d) The City may witness inspection and testing of the materials, when requested prior to testing.
   2. Frequency:
      (a) Twenty percent (20%) of the PVC liner samples, to be selected by the City, shall be tested by the independent laboratory. Additional samples shall be tested, if there are any failures within the first 20%.
   3. Reports:
      (a) Three copies of all certified reports and logs of all tests and inspections conducted shall be submitted directly to the City.

3.16 CURED-IN-PLACE-PIPE (CIPP) POINT REPAIR LINER

A. Install per Section 06010 – Cured-In-Place Pipe (CIPP), CIPP Point Repairs and End Seals.

3.17 WARRANTY

A. The Manufacturer shall warrant the product for a period of 10 years from the date of manufacture, against failure as a result of defects in materials or manufacturing, and that when properly installed the product will perform in accordance with the Manufacturer's specifications. The Contractor shall warrant the PVC liner installation for a period of three (3) years. During the Contractor warranty period, any defects which affect the integrity or strength of the pipe, as identified by the City during routine inspections, shall be repaired at the Contractor's expense in a manner recommended by the manufacturer and mutually agreed by the City and the Contractor.

B. This shall include but not be limited to all material, excavation, backfilling, cutting, concrete, pipe, shoring, temporary pavement, permanent pavement, permits, bypass pumping, surface restoration and other incidental work required to remove the liner from the existing pipe.

C. If removal is not feasible or if removal will cause more harm than acceptable to the host pipeline, alternatives may be proposed by the Contractor to the City for review and approval.

D. The integrity of the existing pipe where the liner was removed shall be rehabilitated by installing another liner or if this procedure is not feasible by installing a new pipe section.

E. There shall be no direct payment, to the Contractor, for this work.

3.18 PROTECTION OF EXISTING WORK

A. PVC liner installations associated with this work may be along or through existing structures, manholes or pipe segments that have previously been rehabilitated.

B. Damage to existing linings (manhole coatings, existing CIPP installations, lateral linings, LCRs, etc...) due to the installation of the new PVC liners or any work associated construction shall be repaired at no additional cost to the City. Requirements include, but is not limited to, the following:

1. Manhole wall corrosion protection top coats that are damaged or removed due to the installation or the installation of the new PVC liner.
2. The previously rehabilitated manhole structure shall be repaired with a similar, compatible product as recommended by the manhole coating material manufacturer.
3. If repair of the existing structure coating is impossible, the existing manhole corrosion prevention product should be removed and the entire structure recoated.

3.19 REJECTION

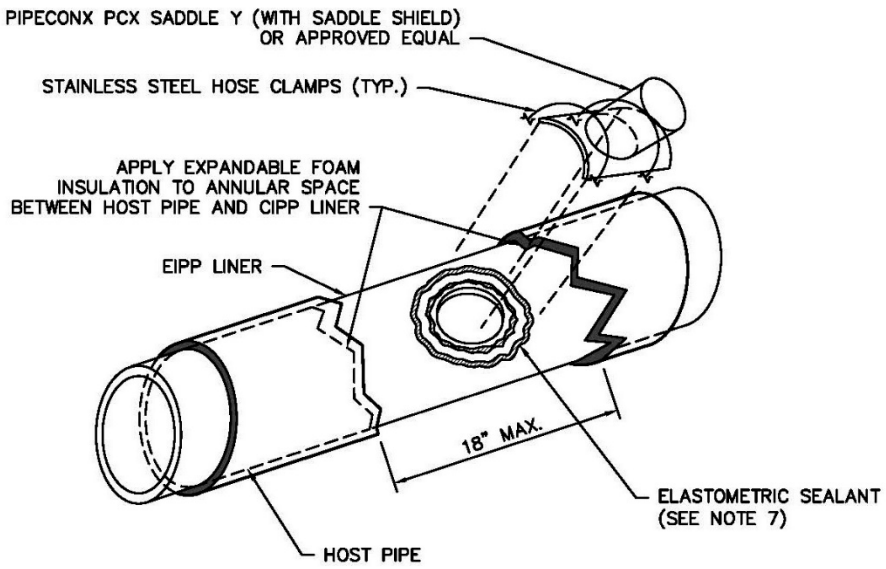
A. Materials and installation may be rejected for failure to meet the requirements of this Section.

3.20 CLEANUP

A. After installation and testing, the Contractor shall clean up the entire project area. All excess material and debris shall be disposed of by the Contractor.

B. Cleanup shall be in accordance with Section 01566 – Cleanup Operations.

Drawing 06015-1 on the following page.



NOTES:

1. EXCAVATE BELOW THE EXISTING SEWER TO COMPLETE THE WORK.
2. CHIP AWAY HOST PIPE ONCE EIPP LINER HAS BEEN INSTALLED AND CURED.
3. CORE EIPP LINED PIPE TO SIZE OF SADDLE OPENING, SAVE COUPON FOR CITY.
4. CONTRACTOR SHALL GRIND DOWN THE EIPP LINER TO MAKE A SMOOTH CONNECTION PRIOR TO APPLYING THE SEALANT.
5. TAKE A PICTURE OF HOLE BEFORE INSTALLING SADDLE.
6. THE CONTRACTOR SHALL CONTACT THE CITY IF THE SADDLE IS UNABLE TO MAKE A GOOD CONNECTION OR IF A TEE SADDLE MUST BE INSTALLED INSTEAD.
7. APPLY TWO BEADS OF CONSEAL CS-1500 SEALANT OR APPROVAL EQUAL AROUND CORE HOLE.
8. ATTACH SADDLE ACCORDING TO MANUFACTURER'S RECOMMENDATIONS,
9. BACKFILL SEWER USING GRANULAR BEDDING AS SPECIFIED IN SECTION 02250 TRENCHING, PIPE EMBEDMENT AND BACKFILL.

SADDLE CONNECTION ON SEWER WITH EIPP

WATER SERVICES
CITY OF KANSAS CITY, MISSOURI
DRAWING NO. 06015-1

DEVELOPED BY: TECHNICAL ADVISORY COMMITTEE
APPROVED BY:
DATE: 9/14/2021

1 OF 1

END OF SECTION