# 02692
SEPARATION OF
WATER MAINS AND
SANITARY SEWERS
SECTION #02692 - SEPARATION OF WATER MAINS AND SEWERS

1.0 SCOPE

A. This section covers the work required to comply with KDHE regulations where water and sewer lines cross or parallel each other. If any sewer or other source of contamination is encountered, the contractor shall cease work and notify the inspector or engineer immediately.

2.0 WATER MAINS AND SEWERS

A. When potable water pipes and sanitary sewers are laid parallel to each other, the horizontal distance between them shall be not less than 10 feet. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them.

B. When a water pipe and a sanitary sewer cross and the sewer is 2 feet or more (clear space) below the water pipe, no extra protection to the latter is needed. At all other crossings, the sewer is to be constructed of either cast iron pipe with leaded joints or approved plastic pipe with bonded joints for a distance of 10 feet in either direction from the crossing. Joints are not to be in the immediate vicinity of the water main and as far from it as practicable. Where water mains are laid across or through an area where there are existing sewers and the extra protection is needed, the existing sewers shall be encased in concrete with a minimum of 6 inches thickness for the required distance on each side of the crossing.

C. The same horizontal separation requirements as listed above apply to water service lines and building sewers. The same vertical distance separations and the extra protections as required above for potable water mains and sanitary sewers apply in the same manner to water service pipes and building sewers.

D. There are to be no physical connections between any parts of the potable water system with building sewers, sanitary sewers, or wastewater treatment facilities by means of which it would be possible for sewage, even under exceptional circumstances, to reach the wells, storage reservoirs, or distribution system.

E. There shall be at least a 10-foot horizontal separation between water mains and sanitary sewer force mains. There shall be a 2-foot vertical separation at crossings as required above.

F. No water pipe shall pass through or come in contact with any part of a sewer manhole.
G. Underground drains from fire hydrants or valve pits should not be directly connected to sewers or storm drains.

3.0 WATER MAINS AND OTHER POLLUTION SOURCES

A. It is of utmost importance that potable waterlines be protected from any source of pollution. The following shall pertain to instances where individual or industrial septic tanks, absorption fields, waste stabilization ponds, wastewater lines discharging into roadside ditches, feedlots, or other sources of pollution are encountered.

B. A minimum distance of 25 feet shall be maintained between all potable waterlines and all septic tanks, waste stabilization ponds, or open sewage discharge locations.

C. Under no circumstances shall a waterline extend through a septic tank, tile absorption field, or feedlot. All waterlines shall be located a minimum of 25 feet from the farthest known extent of any sewage absorption. Under no condition will it be considered that encasement of the water main through an area of real or potential pollution would provide the protection needed for the water supply.

4.0 CROSS-CONNECTIONS

A. There should be no physical connection between the distribution system and any pipes, pumps, hydrants, tanks, or non-potable water supplies whereby unsafe water or other contaminating materials may be discharged or drawn into the system. KDHE approval shall be obtained for interconnections between potable water supplies. KDHE does not approve of interconnections of RWD lines and individual or independent water supply sources such as home wells. Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the potable water supply.
# 02700
SANITARY SEWER
CONSTRUCTION
SPECIFICATIONS
FOR
CONSTRUCTION OF SANITARY SEWERS

1.1 Scope

A. This section shall consist of furnishing all materials, equipment and labor for excavation, trenching, placing of pipe, construction of manholes and appurtenances and backfilling for the sanitary sewage collection system.

2.1 General

A. Clearing and Grubbing: The area within the construction limits on the plans shall be cleared of fences, trees, logs, stumps, brush, vegetation, rubbish, and other perishable or objectionable matter by the Contractor. Costs incurred shall be considered as incidental to other construction and shall not be a bid item. Such fences and structures within the easement shall be replaced by the Contractor, in good condition, satisfactory to the Engineer, unless otherwise specified on the Plans.

B. Construction Stakes: The Engineer will establish construction stakes as necessary to construct the work to the proper lines, grades and dimensions. The Contractor shall furnish and install, at his own expense, all additional stakes, batter boards, and straightedges for lines, levels and measurements. The Contractor shall give the Owner at least 48 hours advanced notice of his need for construction stakes. He shall satisfy himself before commencing work as to the meaning of all stakes and marks. When construction stakes are once set, the Contractor shall preserve them. Any work done without lines and grades as given by the Engineer may be ordered removed and replaced at the expense of the Contractor.

C. Subsurface Obstructions: The drawings indicate the general location of certain utilities and facilities. The Contractor shall locate obstructions by digging in advance of machine excavation where definite information is not available as to their exact location. Where such facilities are unexpectedly encountered and damaged, responsible officials and other affected parties shall be notified. Where closeness of the utility to the work prohibits mechanical excavation and backfill, the contractor work around by hand excavating, tunneling or other improved methods, at the Contractor's expense, where practicable. Where not possible to bypass or work around the facility, the Contractor shall notify the Owner that such removal or relocation work is necessary to permit new construction to lines and grades designated. Cost of such removal or relocation or relocation work shall be borne by the Owner or Utility.
3.1 PROTECTION OF WATER SUPPLIES

A. Separation of Water Mains and Sewers

1. Gravity Sanitary Sewers. When potable water pipes and gravity sanitary sewers are laid parallel to each other, the horizontal distance between them shall not be less than 10 feet (3.0m). The distance shall be measured from edge to edge. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them. In cases where it is not practical to maintain a 10 ft. (3.0m) separation, KDHE will consider a proposal providing equivalent protection supported by other methods on a case by case basis, if supported by data from the design engineer. Equivalent protection may require sanitary sewer construction with one of the following additional protective features: concrete encasement, vacuum sewers, or jointless pipe such as polyethylene or cured-in-place. When a water pipe and a sanitary sewer cross and the sewer is 2 ft (0.6m) or more (clear space) below the water pipe, no special requirements or limitations are provided herein. At all other crossings, the sanitary sewer is to be constructed of one of the following materials (or approved equal) and pressure tested to assure water tightness pursuant to Chapter VI of the KDHE Minimum Standards of Design of Water Pollution Control Facilities:

a. Ductile iron pipe conforming to ASTM A536 or ANSI/AWWA C151/A21 with minimum thickness class 50, and gasketed, push-on or mechanical joints in conformance with ANSI/AWWA C111/A21.11.

b. PVC pipe conforming to ASTM D3034 with minimum wall thickness of SDR41, ASTM F679, ASTM F789, or ASTM F794, with gasketed push-on joints in conformance with ASTM D3212.

c. Reinforced concrete pipe conforming to ASTM C76 with gasketed joints in conformance with ASTM C361 or ASTM C443. Joints in the sewer pipe shall be located as far as practical from the intersected water main. Where a water main is laid across or through an area where there is an existing sanitary sewer, which is not constructed of one of the above specified materials and is 2 ft (0.6m) or less below the water pipe, the existing sewer shall be encased in concrete with a minimum of 6 in. (15cm) thickness for a 10 ft. (3.0m) distance on each side of the crossing or the crossed section or sewer replaced to meet the above specified construction requirements. KDHE will consider proposals providing equivalent protection by other means on a
case-by-case basis, if supported by data from the design engineer.

2. Sewer Connections. There are to be no physical connections between any parts of the potable water system with building sewers, sanitary sewers, or wastewater treatment facilities by means of which it would be possible for sewage, even under exceptional circumstances, to reach the wells, storage reservoirs, or distribution systems.

3. Pressure Sewer Lines. When force mains run parallel to water lines, the separation distance shall be as far as practical, but at least a 10 ft. (3.0m) horizontal separation shall be maintained. There shall be at least a 2 ft (0.6m) vertical separation at crossings with the water main crossing above the sewer force main. In cases where it is not practical to maintain the required vertical or horizontal separation distance between a water line and a sanitary sewer force main, KDHE will consider proposals providing equivalent protection by other methods on a case-by-case basis, if supported by data from the design engineer.

4. Sewer Manholes. No water pipe shall pass through or come in contact with any part of a sewer manhole.

5. Storm Sewers. The separation distance between a storm sewer (which is not a combined storm/sanitary sewer) and a water main should be based on geotechnical considerations. Required separation distances between water mains and combined storm/sanitary sewers are equivalent to those for water mains and gravity sanitary sewers.

6. Drains. Underground drains from fire hydrants or valve pits should not be directly connected to sanitary or storm drains.

B. Separation of Water Mains and other Pollution Sources. It is of utmost importance that potable water lines be protected from any source of pollution. The following shall pertain to instances where septic tanks, absorption fields, waste stabilization ponds, feedlots, or other sources of pollution are encountered.

1. Tanks and Ponds. A minimum of 25 ft. (7.6m) shall be maintained between all potable water lines and all septic tanks or waste stabilization ponds.

2. Fields and Feedlots. Under no circumstances shall a water line extend through a septic tank absorption field or feedlot. All water lines shall be located a minimum of 25 ft. (7.6m) from the farthest known extent of any sewage contamination. Under no condition will it be considered
that encasement of the water main through an area of real or potential pollution would provide the protection needed to the water supply.

C. Cross Connections. There shall be no physical connection between the PWSS and any pipes, pumps, hydrants, tanks, or non-potable waters supplies whereby unsafe water or other contaminating materials may be discharged or drawn into the system. KDHE approval shall be obtained for interconnections between potable water supplies. KDHE does not approve of interconnections of RWD lines and individual or independent water supply sources such as private and domestic wells.

4.1 SEWER PIPE INSTALLATION

A. General. This section covers excavating, trenching, placement of pipe and backfilling for sanitary sewer lines and appurtenances, and all incidental work in connection therewith, including disposing of surplus and waste materials and cleanup.

B. Classification of Excavation. All excavation will be unclassified.

C. Surface Drainage: shall be diverted away from the site of open excavations and trenches. Surface water, which enters or accumulates in open excavations or trenches, shall be removed and the sub-grade or pipe bed restored to original bearing value and condition at no additional expense to the Owner.

D. Excavation of Trench: The open trench shall be excavated beginning at the outlet end and proceeding toward the upper end on a true line and grade as shown on the Plans. Blasting will not be permitted. The foundation of the trench shall be at least 4 inches below the pipe to permit placement of bedding. The foundation of the trench shall be free from standing water and firm at time of bedding and pipe placement. Over excavation shall be replaced with bedding material and compacted. No more than 400 feet of trench shall be open at a time. (For additional information see "Excavation & Trenching.")

E. Dewatering: Where conditions are such that running or standing water occurs in the trench bottom or the soil in the trench displays a "quick" tendency, the water shall be removed by pumps and suitable means such as well points or pervious underdrain bedding until the pipe has been installed and the backfill has been placed to a sufficient height to prevent pipe flotation. Care shall be taken that any underdrain is of proper graduation and thickness to prevent migration of material between the underdrain, pipe embedment and native soils in the trench below and at the sides of the pipe. (For additional information see "Excavation & Trenching.")
F. **Boring:** Boring shall be accomplished by the dry method. No water jetting will be permitted. Excess voids and any abandoned boreholes shall be filled with pressure grout. (For additional information see "Boring and Encasement.")

G. **Shoring and Bracing:** All shoring, bracing and blocking shall be furnished and installed as required to preserve and maintain exposed excavation faces, to protect existing facilities, and to provide for the safety of workmen and the general public. All shoring requirements shall be equal or greater than those issued by O.S.H.A.

H. **Inspection of Materials:** The Contractor shall inspect all pipe sections and other materials prior to installation. All damaged or otherwise unfit material shall be removed from the project site. Foreign material, including dirt, shall be removed from the pipe prior to placement.

I. **Laying:** The laying of pipe shall start at the outlet end so that the spigot end points in the direction of the flow. The bedding shall be so graded that the pipe is supported throughout its entire length. A depression shall be made for the bells. Lubricant used for pipe joining shall be as recommended by the manufacturer. Spigots shall be inserted into the bell to the insertion mark so that the mark is just visible. No joints shall be covered until inspected and approved by the Engineer. The pipe shall be laid to a true grade and alignment so as to permit lamping between manholes.

J. **Pipe in Fill Sections:** A pipe bed and embankment, if required, shall be constructed of selected material which shall be placed systematically on each side of pipe in six (6") layers and thoroughly compacted.

K. **Site Grading:** Upon completion of backfilling and trenching work, the entire site of the work shall be graded to smooth and uniform slope to match the line and grades of the surrounding area, no dips or depressions shall remain in the work area. The contractor shall use the appropriate equipment necessary to obtain the above results. Waste areas and stockpiles shall be broken down and removed, presenting no obstructions to natural drainage. The entire work area or area occupied and used by the contractor shall be clean, smooth and uniform so as to allow for seeding by the seeding contractor or landowner. All excess dirt, rocks, rubble, debris, etc., shall be removed from the project and disposed of at a site approved by the Engineer.

5.1 **PIPE MATERIALS**

A. **Gravity Sewer Pipe:** The Gravity Sewer Pipe shall be PVC SDR35 unless otherwise noted. Joints shall have rubber-sealing rings. Pipe shall be J-M Ring-Tite or CertainTeed PVC Gravity Sewer Pipe or Equal. When the use of
Ductile Cast Iron is specified, (for specific situations such as Highway Crossings and Railroad crossings) it shall be Class 150 conforming to ASTM A377.

B. Gravity Sewer Fittings: The PVC Gravity Sewer Fittings shall be PVC SDR35 unless otherwise noted. The fittings shall meet the requirements of ASTM D3034 in sizes 4" - 15". Fittings shall be J-M Ring-Tite or CertainTeed PVC Gravity Fittings or equal. The fittings gaskets shall meet ASTM F 477.

6.1 MANHOLES

A. Excavation and Backfill: At designated locations, trenches shall be deepened and enlarged as required to permit construction of manholes. Limits of excavation shall be no wider than necessary for manhole construction and installation. Backfilling shall conform to applicable requirements for trenches at the respective location.

B. Manhole Material: All Manholes shall be Precast Concrete and shall conform to the current ASTM specifications C 478 except for the following modifications. Cement used in the construction of precast reinforced concrete manholes shall conform to the requirements of the Standard Specifications for Portland Cement (ASTM Designation: C150). The compressive strength of the concrete shall be not less than 4,000 psi.

1. The minimum shell thickness for precast concrete reinforced manholes shall be:

   At a depth of 0 to 16 ft.  One-twelfth internal shell diameter or 4 inches, whichever is greater.

   At a depth of 16 feet or greater.  One-twelfth internal shell diameter plus one inch, or 5 inches, whichever is greater.

C. Joints: Joints between precast reinforced concrete sections shall be of such design that leakage and infiltration can satisfactorily be reduced to the limits noted in the Infiltration-Exfiltration tests section. The use of mastics or rubber gaskets (natural or synthetic) is required for this purpose. If the vacuum test method is used to test the manhole a hydraulic cement grout shall be used to seal joints and lift holes in addition to the mastics or gaskets.

D. Base Construction: The base shall be poured of 3,000 (minimum) psi concrete with a maximum slump of 4 inches and consolidated by vibration. The bottom sections of all precast reinforced concrete manholes shall extend into the
concrete base a minimum distance of 4 inches. The base shall have a minimum diameter 8 inches greater than the outside diameter of the manhole. The base shall have a minimum thickness beneath the area of the manhole wall as follows:

- 0 ft. to 8 ft. manhole heights...8 inches
- 8 ft. to 12 ft. manhole heights...10 inches
- 12 ft. and above manhole heights...12 inches

Steel reinforcing in the manhole base shall be #4 rebars at 12" centers both ways. All interior surfaces of poured in place concrete shall be steel trowel finished. Dips or projections capable of holding water or solid materials will not be permitted. The concrete shall set for 24 hours before any pipe inside the manhole is trimmed.

E. Inspection of Materials: Any material which has been damaged such that the water-tightness or structural integrity of the section has been affected adversely shall not be utilized in the construction of the manhole.

F. Drop Type: Where shown on the Plans, an outside drop line shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. The outside drop pipe shall be protected against breaking or settling by the use of a concrete encasement. The drop pipe shall have the same nominal diameter as that of the incoming sewer.

G. Diameter: The minimum inside diameter of manholes shall be 48 inches. The minimum diameter of manhole covers and manhole entry ways shall be 22 inches.

H. Flow Channel: The flow channel through manholes shall be made to conform in shape and in slope to that of the sewers. Sewer pipe shall be stubbed into the manhole and then concrete or grout used to create a smooth uniform transition through the manhole.

I. Castings: Unless otherwise shown on the plans shall be: Manhole steps made of gray cast iron conforming to ASTM A 48 or Plastic coated cast or other corrosion resistant materials shall be provided whenever the manhole is deeper than 4 feet. Steps shall be spaced at intervals no greater than 16 inches. Manhole Ring and Lid shall be "Heavy Duty" with the following minimum weights:

- Ring: 217 Lbs.
- Lid: 147 Lbs.

J. Connection between Manhole and Pipe: All sewers extending from manholes shall be supported with concrete to the first 3 feet of pipe from the manhole.
wall. Concrete support may be eliminated if a flexible water-tite gasket joint is used to join the pipe to the manhole. (A-Lock 285 gasket or approved equal.)

7.1 BRANCH FITTINGS & SERVICE LINES

A. Branch Fittings: Fittings for service lines in new construction shall be molded or fabricated with all gasketed connections. Wyes, Tees or saddle branch fittings shall be installed at all service line locations. The contractor shall have the option of installing in-line wyes or tees during the normal installation of the sewer pipe or tapping the new line and installing a gasketed saddle wye or tee.

If the contractor elects to use in-line fittings, he shall provide the necessary caps or plugs for each fitting, in order for the proper testing of the sewer line. If the contractor elects to tap the line after testing, he shall use gasketed saddles with stainless steel clamps. Saddles and/or fittings shall be installed according to manufacturer's recommendations.

B. Vertical Risers: Where conditions permit, the branch connection (wye/saddle) shall be set at no greater than 45 degrees to the horizontal and the riser brought to the appropriate location utilizing no greater slope than that given by the branch connection angle. In situations where the sewer trench is of minimum width and the trench walls are of vertical, firm, undisturbed materials, the branch connection shall be set at 45 degree to the horizontal and 45-degree bend shall be placed on the branch. The branch and bend shall be encased in concrete, unless solvent welded PVC pipe is used. The riser pipe shall be set into the 45-degree bend and extended up the trench wall to the appropriate depth. Each pipe joint shall be securely pinned in place to prevent movement of pipe when backfilling.

C. Fittings Location: After wyes are laid and before trench is backfilled, the stationing shall be obtained for the wye location. An accurate record of the location of each wye shall be kept by the Contractor, independently of records kept by the Resident Inspector. In the event such records are not kept, or are lost or destroyed before final acceptance of the work, the locations shall be redetermined by the Contractor at no additional cost.

D. Service Lines: The contractor shall when making connections to existing service lines from fittings use good, clean, and appropriate plumbing fittings and pipe. The sewer pipe used to make the connection shall not be less that Schedule 40 pipe and shall have neoprene/rubber gaskets using stainless steel clamps. Any deviation from this standard shall require the inspector/engineer's approval.
8.1 INSPECTION AND TESTS (SEWER PIPE & MANHOLES)

A. Sewer Pipe

1. Inspection of Joints: Joints shall not be covered until approved by the Engineer.

2. Approval of Materials: Materials may be used if accompanied by a Manufacturer's Certificate of compliance pending any test which may be made by the Engineer. Bituminous joint materials shall be delivered on the job in the manufacturer's container fully marked and unopened.

3. Alignment and Grade: After joints have been inspected and approved, the trench shall be backfilled to 12" above pipe as specified in "Excavate and Trenching." The Engineer shall check the trueness of the grade and alignment by lamping between manholes. The balance of the backfill shall be done only upon authority from the Engineer.

4. Testing: After the pipe has been laid and backfilled the line may be tested between manholes by low-pressure (ASTM F-1417) or water infiltration-exfiltration test method. The Engineer shall be notified in advance of the method to be used by the contractor. The contractor shall provide the Engineer with schedule and procedure of testing method. No testing shall be started or completed without the Engineer or Inspector approving method and being present during tests. ASTM C-828 is the recommended testing method for Vitrified Clay Pipe and other similar pipe, while ASTM F-1417 is the recommended testing method for Plastic Pipe and other similar material pipe.

a. Infiltration/Exfiltration: The following information is not intended to be all inclusive of the method, procedure, equipment or manner of this type of test. It is only intended to make the contractor aware of type of procedure and the approximate amount of work involved. The contractor shall be responsible to obtain the required information to complete, perform and document this test.

i. Infiltration: Tests for water-tightness shall be made by the Contractor in the presence of the Engineer. The sewer and connections shall not leak under the exterior normal ground water pressure in excess of the rate of 250 gal. per inch or nominal diameter per mile of sewer per day. If such leakage occurs, the Contractor shall locate any leakage and make repairs as necessary to control the
infiltration. The tests and measurements of infiltration shall be conducted in a manner as approved by the Engineer.

ii. Exfiltration: The contractor shall conduct an exfiltration test on each reach of sewer between manholes. The first line between manholes shall be tested before backfilling and before any sewer pipe is installed in the remainder of the work. Thereafter, individual or multiple reaches may be tested at the frequency recommended by the contractor and approved by the Engineer.

Exfiltration tests shall be conducted by blocking off all manhole openings except those connecting with the reach being tested, filling the line, and measuring the water required to maintain a constant level in the manholes. Each manhole shall be subjected to at least one exfiltration test. During the exfiltration test, the average water depth above the pipe invert shall be 10 feet, unless manhole depths are such that this is impossible. The maximum depth at the lower end shall not exceed 20 feet and the minimum depth at the upper end shall be at least 5 feet above the crown of the pipe.

The total exfiltration for 12-inch pipe shall not exceed 0.57 gallons per foot per day when there is a 4 foot minimum static head above the pipe invert. The exfiltration for a 10-inch pipe shall not exceed 0.47 gallons per foot per day when there is a 4-foot minimum static head. The total exfiltration for any other size pipe shall not exceed 250 gallons per inch of nominal diameter per mile of pipe per day for each section tested. The minimum length of test shall be 4 hours or as long as necessary to locate all leaks when requested by the Engineer.

b. Vacuum Testing / ASTM F-1417: The following information is not intended to be all inclusive of the method, procedure, equipment or manner of this type of test. It is only intended to make the contractor aware of type of procedure and the approximate amount of work involved. The contractor shall be responsible to obtain the required information to complete, perform and document this test.

i. Procedure/Method: Low-pressure air testing may be conducted on any type of 8 inch to 12 inch diameter pipe.
Testing methods and air leakage rates shall conform to Uni-Bell's UNI-B-6-85 Standard and/or ASTM F-1417 or their latest revision.

ii. Line Plugs: After a manhole to manhole reach of pipe has been backfilled to final grade, and prepared for testing, the section of sewer pipe to test shall be cleaned by flushing or other methods. After the line is cleaned, isolate the section of pipe to be tested with the use of inflatable stoppers or other suitable test plugs. The plugs shall be placed in the line at each manhole and secured. The seals shall be tested for sealing by pressurizing the pipe to a minimum of 4 psig but not greater than 9 psig. The plugs shall hold against this pressure without bracing and without any movement of plugs.

iii. Constant Pressure Method: When it is determined the pipe plugs are holding against the 4 psig, then the pressure may be lowered to 3.5 psig greater than the average groundwater back pressure. The airflow rate in standard cubic feet per minute is read directly with the use of an rotameter, which the contractor shall provide. Conversion of this airflow to actual cubic feet per minute of air leaking from the test sections shall be done. The requirements for air loss under constant pressure method shall be considered satisfied if the air loss does not exceed the specified leakage rate in cubic feet per minute per square foot of internal pipe surface area.

iv. Time-Pressure Drop Method: When it is determined the pipe plugs are holding against the 4 psi, and the test section has stabilized, this method may begin. Disconnect the air supply and decrease the pressure to 3.5 psi. Timing shall commence with an accurate timing device. The time required for a 1.0 psig specified pressure drop shall be used to determine the lines acceptability. This time shall be as listed in the table at the end of this section.
8.2 MANHOLES

A. Inspection of Manholes: Manholes shall not be backfilled until approved by the Engineer.

B. Approval of Materials: Materials may be used if accompanied by a Manufacturer's Certificate of compliance pending any test, which may be made by the Engineer. Bituminous joint materials shall be delivered on the job in the manufacturer's container fully marked and unopened.

C. Testing: After the manhole has been placed and before the hole is backfilled the manhole shall be tested using either the hydrostatic method or the low-pressure vacuum method. The Engineer shall be notified in advance of the method to be used by the contractor.

1. Hydrostatic Method: Manholes shall be tested using internal hydrostatic pressure. Full depth exfiltration (max. 25 feet) shall have a water loss of less than 1.14 gallons per foot of manhole depth per 24 hour period. If Infiltration occurs before or after the exfiltration test, it shall also be less than 1.14 gal/foot of depth @ 24 hour period.

2. Vacuum Test Method.
   a. All lift holes shall be plugged with an approved non-shrink grout.
   b. All pipes entering the manhole shall be plugged, (ex. Kor-N-Seal) taking care to securely brace the plug from being drawn into the manhole.
   c. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.
   d. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for 48" dia., and 75 seconds for 60" dia. manholes.
   e. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.
8.3 PAYMENT FOR TESTS

A. The contractor shall provide, at his own expense, all necessary piping, water, equipment and materials required for the tests. The tests shall not be a bid item and they shall be considered subsidiary to other work.

8.4 FINAL ACCEPTANCE

A. Before any newly constructed Sanitary Sewer is placed into service, all installations shall comply with all tests to the satisfaction of the Engineer. Until the Contractor is notified of acceptance, he shall maintain the entire work in good order. When such compliance is met, the Engineer will so advise the Owner.

TABLE NO. 1

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#02715
POLYVINYL CHLORIDE
SEWER PIPE
SECTION #02715 - PVC SEWER PIPE

1.0 SCOPE

A. This Section covers the quality specifications and placement techniques of the sanitary sewer pipe.

2.0 GRAVITY SEWER

A. The gravity sewer pipe shall be PVC, and shall meet the requirements of: ASTM Specification D 3034 (SDR 35), Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, 4" through 15". The gaskets shall meet the requirements of ASTM F 477. The joints shall meet the requirements of ASTM D 3212. Joints shall have rubber-sealing rings. Pipe shall be J-M Ring-Tite PVC Sewer Pipe, or CertainTeed PVC Gravity Sewer Pipe, or equal.

3.0 INSTALLATION

A. Prior to installation, the pipe shall be inspected for damage and care taken to remove foreign material from within the pipe and to assure a clean bell and spigot. The spigot shall be lubricated with material supplied by the pipe manufacturer and applied as per supplier specifications. Pipes shall be joined to the reference mark. Installation of sewer pipe shall conform to the specifications for "Construction of Sanitary Sewers."

4.0 CUTTING

A. When cutting of the pipe is required, the cut shall be square. The end shall be beveled to conform to the factory bevel.

5.0 GRADE AND ALIGNMENT

A. The gravity sewer must be laid to the grade shown on the Plans. No pipe shall be installed until the Engineer is assured of proper grade and alignment. A light must be visible between manholes on gravity sewer. Installation of sewer pipe shall conform to the specifications for "Construction of Sanitary Sewers."
6.0 BACKFILL

A. Care shall be taken not to move the pipe during backfill procedures and to meet all backfill requirements. All excavation and trenching shall conform to the specifications listed in "Excavation and Trenching."

7.0 TESTS

A. All installed sewer pipe shall meet or exceed the testing requirements listed in the specifications for the "Construction of Sanitary Sewer."

8.0 SUBMITTALS

A. A contractor may submit to the Engineer information concerning a different manufacturer's pipe, other than that specified above, for verification of status "or equal". The Engineer and/or the Owner reserves the right to reject any manufacturer's pipe submitted for "as equal" status, for any reason. It shall be the contractor's responsibility to submit the necessary information to seek "or equal" status, to the Engineer prior to the bid letting allowing the Engineer enough time to verified pipe's status. Any submittals received by the Engineer within seven calendar days of the bid letting will not be considered for approval.
# 02725
EXISTING SANITARY SEWER MANHOLE REHABILITATION
1.1 SCOPE

The intent of this specification is to provide the contractor with the minimum requirements of the information that the Engineer needs to receive, and approve for a system of rehabilitating the existing sanitary sewer manholes, which may remain in place if trenchless excavation procedures are used for the replacement of the existing sanitary sewer line.

2.1 SUBMITTALS

The contractor shall submit the following information on the type of rehabilitation process he proposes to use on this project.

A. Manufacturer Specifications of Materials
B. Method of preparation of existing Manhole
C. Method of application/installation of rehabilitation material.
D. Method of protecting existing and new sewer line from rehabilitation process.
E. Experience with rehabilitation process.
   1. Time frame contractor has been using process
   2. Projects/Jobs process used on (Town, Year, Contact Person, Telephone Number, Number of Manholes)
F. Written Extended Warranty of materials and workmanship

3.1 TESTING OF REHABILITATED MANHOLES

A. After completion of manhole construction, wall sealing, or rehabilitation, test manholes for water tightness using testing procedures and methods listed in Section "Sanitary Sewer Construction".

4.1 ACCEPTANCE

A. Correction of manhole rehabilitation work deemed unacceptable, as indicated by the leakage test, air test, visual inspection, and/or test reports for structural
values, thickness, chemical resistance, etc., as listed in the specifications submitted by the contractor and listed in this book shall be the responsibility of the Contractor.

B. Patching, infiltration control, and liner/coating work shall be guaranteed for a standard period of 1 year against partial or complete failure, said warranty shall be in writing.

5.1 SPECIAL NOTE

A. The City reserves the right to replace existing manholes with new concrete manholes if the rehabilitation process is more costly than the process of replacement.

B. If the City replaces existing manholes with new concrete manholes the specifications under section, "Sanitary Sewer Construction" dealing with concrete manholes shall govern.
# 02726
SANITARY SEWER
MANHOLE CLOSURE
1.1 **Scope**

The purpose of this specification is to provide the contractor with information concerning the purpose and the intended finished product of the bid item "Close Existing Manhole".

2.1 **Work to Perform**

The work required of the contractor for this item is to fill the lower portion of the existing manhole, and remove the upper portion while still retaining the existing sewer flow through the manhole.

A. **Lower portion of Manhole:** The contractor shall install an imperious shield across the inverts and sanitary sewer pipe at the bottom of each manhole. The shield shall be constructed of a material that will support the weight of the fill above the shield. The shield shall also cover the entire bottom of the manhole and shall leave no holes or imperfections, which will allow the fill to penetrate the shield and create blockage in the sewer flow.

B. **Manhole fill:** Once the shield has been installed the contractor shall fill the lower portion of the manhole with "flowable concrete backfill." The mix design for the flowable concrete backfill shall have a compressive strength of 75 - 175 psi, and it shall be approved by the Engineer prior to use. The flowable backfill shall continue to an elevation of not less than 3 feet or more than 4 feet from the top of the manhole. There shall be a minimum of 42 inches of fill in the lower portion of the manhole.

C. **Upper portion of Manhole:** After the flowable concrete backfill has been allowed ample time to "cure", the remaining upper portion of the existing manhole shall be filled with "blow sand."

3.1 **Payment**

The payment for the bid item, "Closing Existing Manhole", shall include all the work, materials, and any other items necessary to complete the work as described and specified above. Any questions concerning the method, material, or costs of this bid item shall be addressed to the Engineer, prior to any work being started.
SPECIFICATIONS
FOR
STORM SEWER
CONSTRUCTION
# 02721 STORM SEWER INSTALLATION

1.0 DESCRIPTION

A. Work under this section shall consist of furnishing all materials, equipment and labor for excavation, trenching, placing of pipe, construction of inlets and backfilling for storm sewers or drainage pipes as shown on the plans.

2.0 TYPES OF STORM SEWER

A. Round Concrete Pipe Class II (RCP): Concrete Pipe shall be pre-cast and laid, erected or installed for locations having a minimum of two feet of cover, and shall meet KDOT Specifications Section 1902 or AASHTO M-170.

B. Round Concrete Pipe Class III (RCP): Concrete Pipe shall be pre-cast and laid, erected or installed for locations having less than two feet of cover, and shall meet KDOT Specifications Section 1902 or AASHTO M-170.

C. Reinforced Concrete Arch Pipe (RCAP), Reinforced Concrete Horizontal Elliptical Pipe (RCHEP) shall be pre-cast and laid, erected or installed for locations having the same depth classifications as RCP, and shall meet KDOT Specifications Section 1902 or AASHTO M-206 and M-207.

D. Round or Arched Corrugated Steel Pipe (CMP) (CMAP): The pipe shall be laid, erected or installed using a minimum of 14 gauge steel and shall meet KDOT Specifications Section 1905 and AASHTO M36.

E. Round or Arched Corrugated Aluminum Alloy Pipe (CAAP): The pipe shall be laid, erected or installed using a minimum of 14 gauge steel and shall meet KDOT Specifications Section 1905 and AASHTO M-196.

F. Round Polyvinyl Chloride Pipe (PVC) or Round Corrugated Polyethylene Pipe (CPEP) also known as (HDPE): The pipe shall be laid, erected or installed using a minimum cover of 12", and shall meet KDOT Specifications Section 1909 & 1910 and ASTM D3034, F758, F894 F714 or AASHTO M-294.

3.0 INSTALLATION

A. Excavation:

1. The trench shall be excavated beginning at the outlet end and proceeding toward the upper end, true to line and grade shown on the plans or as established by the Engineer. The width of the trench shall be
sufficient to lay, placing bedding as required and to place backfill, but in no case shall be less than the external diameter of the pipe plus six inches on each side.

2. When necessary, according to safety regulations, common sense, and good construction practices the trench shall be adequately shored or sheeted to insure safe and satisfactory construction and backfilling.

3. The foundation in the trench shall be so formed as to prevent subsequent settlement. If the foundation is mealy soil and can be worked easily then bedding will not be required. All other circumstances dealing with poor trench foundation, rocky soil, debris, or geological reasons the storm sewer shall be bedded according to the bedding requirements.

4. If the foundation is in good firm earth, the earth shall be pared or molded to give full support to each pipe for a depth at least equal to 1/4 the external diameter of the pipe, notches being cut to receive the bell (when bell and spigot pipe is used).

5. The contractor shall have the option to undercut the trench and backfill at his expense, with bedding materials to insure proper, uniform bearing of the storm sewer pipe.

B. Laying/Installation:

1. The laying of pipes in finished trenches shall be started at the outlet end so that the spigot ends (when bell and spigot pipe is used) point to the direction of flow.

2. All pipes shall be laid with ends abutting or connected and true to line and grade.

3. Pipes shall be so lowered into trenches as to avoid unnecessary handling and damage to the pipe.

4. Sections of corrugated metal pipe shall be placed with ends abutting and joined with the manufacturers coupling bands.

5. All concrete pipe shall be installed using plastic joint compound or the manufacturer's recommended mastic compound caulking strips to join the sections. At the Engineer's approval cement mortar or grout may be used in lieu of either plastic compound.

6. As each section of pipe is laid, the bell or hub of the preceding pipe shall be cleaned and the bottom portion kept free from any foreign materials as the two pipes are joined.
7. All joints and lift holes to be sealed to provide a tight, water resistant surface.

C. Bedding of Pipe:

1. When required the pipe shall be bedded in crushed stone or rounded gravel-bedding material placed on the trench bottom. The bedding material shall have 95% passing a 3/4" sieve and 45% retained on a No. 8 sieve. The material UD-1 of the KDOT Standard Specifications for Under-drain aggregates will be considered suitable, as well as, a well-graded road gravel blend. The contractor shall deliver a sample of the material he proposes to use to the Engineer for approval.

2. The bedding shall have a minimum thickness beneath the pipe of 6" (inches) or one/sixth (1/6) of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to a minimum of 12" (inches) or one/fourth (1/4) the outside diameter of the pipe, whichever is greater. No separate payment will be made for pipeline bedding, such work and materials being subsidiary to the pipe.

4. JUNCTION AND/OR TRANSITION BOXES

A. The construction of junctions and/or transition boxes shall be in accordance with concrete construction specifications for miscellaneous structures.

5. METHOD OF MEASUREMENT AND PAYMENT

A. Concrete Pipe shall be measured from the inside of pipe. Distances across boxes or transition sections will not be counted as pipe length. The price per linear foot shall be full compensation for placing all materials, for all labor, equipment, tools and incidentals necessary to complete the work.
# 02766
TRENCHLESS
SANITARY SEWER LINE
INSTALLATION
1.1 SCOPE

This section covers work required to install new sanitary sewer pipeline through other methods other than the excavation of a trench. The accepted methods of trenchless excavation are Pipe-Bursting or Augering/Reaming Method and Cured in Place Pipe Method. All other methods will require approval prior to bidding.

2.1 PIPE BURSTING/AUGERING/REAMING METHOD (PBARM)

The PBARM process is defined as the rehabilitation of gravity sewer pipe by expanding or removing the existing sewer pipe and installing a new line of equal or greater diameter into the cavity created by the bursting or augering process.

A. A tool, of greater maximum outside diameter that the maximum inside diameter of the existing sewer pipe, shall be drawn, pushed, or drilled along the inside bore of the old existing sewer pipeline such that the old sewer pipe is broken up into small fragments and those fragments are driven into the surrounding pipe zone or become a slurry mix which flow around the pipe being installed.

B. The tool shall make a tunnel along the path formerly occupied by the old sewer pipeline, and directly behind the tool, shall install the new pipeline by pulling it into place in the tunnel.

C. The tool shall be of dimensions such that the design maximum diameter of the tunnel shall not exceed the maximum outside diameter of the new pipe, plus 3 inches.

D. Submittals: Contractor shall submit data concerning shop drawings of procedures, pipe materials and other materials or appurtenances used in this work prior to beginning any work.

E. Plan of Operations: Prior to the pre-construction conference, the contractor shall submit a plan indicating the sequence of operations for EACH replacement section. The Contractor shall not be allowed to start any construction activities until his plan of operation has been approved by the Engineer.

F. Materials:

1. Replacement Pipe: The replacement pipe shall be manufactured from a high density high molecular weight polyethylene resin which conforms
to ASTM D-1248 and meets the requirements for Type III, Class B, Grade P34, Category 5, and has an PPI rating of PE 3408, when compounded. The pipe produced from this resin shall have a minimum cell classification of 345434D or E under ASTM D3350.

2. Clamps: Clamps for replacement pipe connection at excavations between two manholes shall be all stainless steel, full circle universal clamp couplings with a 1/4 inch min. thickness, and a grid type gasket. Minimum clamp width for 8-inch nominal pipe shall be 18 inches.

G. PRE-INSTALLATION: The contractor shall submit a work plan to the Engineer for review and acceptance. The work shall address the following minimum preparation steps, unless approved otherwise by the Engineer.

1. Pre-Installation Television Inspection: It shall be the responsibility of the Contractor to video (TV) inspect the sewer pipe before the PBARM. This inspection shall be incidental to the installation of the replacement pipe. A video tape and suitable log shall be kept for later reference by the City. The Engineer or City may waive this phase depending on certain conditions. This inspection shall be for, but not limited to, the following purpose.

a. To assure that existing pipe conditions are acceptable for PBARM.

b. To locate all active service line connections.

c. To identify and locate any line obstructions that cannot be removed by conventional sewer cleaning equipment, which would prevent/hinder the PBARM process.

d. To verify the existing condition of parallel line in the event of potential damage during the PBARM process.

2 Bypassing Sewage: When required for acceptable completion of the PBARM process, the contractor shall provide for continuous sewage flow around the section(s) of pipe designed for the installation of replacement pipe. The pump bypass lines shall be of adequate capacity and size to handle the flow, and the contractor shall submit a detailed narrative of the bypass plan to the Engineer prior to the PBARM process.

3. Line Obstructions: If pre-installation video (TV) inspection reveals an obstruction in the existing sewer which will prevent completion of the
PBARM process, and that cannot be removed by conventional sewer cleaning equipment, then a point repair shall be made by the contractor, with the approval of the Engineer.

4. Sags in Line: If pre-installation video (TV) inspection reveals a sag in the existing sewer that is greater than one-half the diameter of the existing pipe, it shall be the contractor's responsibility to install the replacement pipe to result in an acceptable grade without the sag. The contractor shall take the necessary measures to eliminate these sags by the method of: pipe replacement, digging a sag elimination pit and bringing the existing pipe trench to a uniform grade in line with the existing pipe or by other measures. If required, this shall be considered as a point repair.

5. Insertion/Machine/Access Pits: The locations and number of insertion, machine or access pits shall be planned by the contractor and approved by the Engineer prior to excavation. The pits shall be located so that their total number shall be minimized and the length of replacement pipe installed in a single pull shall be maximized.

6. Manholes: Any manhole modification, damaged, or destruction created or caused by the contractor's insertion process shall be repaired or replaced at the contractor's expense.

7. Traffic: If a street must be closed to traffic because of the orientation of the sewer and the contractor's work, it shall be the responsibility to temporarily close the street. The contractor shall notify the City of all closures so as not to hindered emergency medical/fire or relief efforts.

H. INSTALLATION: The Contractor shall submit information in detail, of the procedure and the steps to be followed for the installation of the PBARM process. All such instructions and procedures submitted shall be carefully followed during installation. Any proposed changes in installation procedures shall require the approval of the Engineer.

1. Finished Pipe: The installed replacement pipe shall be continuous over the entire length of each pipe segment from manhole to manhole and shall be free from visual defects such as foreign inclusions, concentrated ridges, discoloration, pitting, varying wall thickness and other deformities. The replacement pipe passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by the Engineer. The installed pipe shall meet the leakage and pressure test requirements specified in the Sanitary Sewer Construction section. During the project correction period, which shall be defined as twelve (12) calendar months after final acceptance by the City, any defect, which will affect the integrity or strength of the pipe shall be repaired at
the Contractor's expense in a manner mutually agreed to by the City and the Contractor. Approximately 11 months after Final acceptance of completed work, "Follow-up Televising" shall be done. The follow-up television inspection shall be considered subsidiary to the project, at no extra cost to the city. Any required correction shall be the responsibility of the Contractor. The Contractor shall provide the City with two complete sets of the color videotape taken by a 360 degrees radial view camera. The City may eliminate this Follow-Up Televising at their own discretion, upon notification of the Contractor, prior to the end of the 11 month period.

2. Pipe Jointing: Sections of polyethylene replacement pipe shall be assembled and joined on the job site above ground. Jointing shall be accomplished by the heating and butt-fusion method in strict conformance with the manufacturer's instructions.

The butt-fusion method for pipe joining shall be carried out in the field by certified operators with prior experience in fusing polyethylene pipe with similar equipment using proper jigs and tools per standard procedures outlined by the pipe manufacturer. These joints shall have a smooth, uniform, double rolled back bead made while applying the proper melt, pressure and alignment. All joints shall be made available for inspection by the Engineer before insertion. The maximum length of continuous replacement pipe shall be determined by the Contractor and the Engineer, based upon job site conditions.

3. Excavation For Machine/Insertion/Access Pits: One or more machine pits shall be excavated at ends of the line to be replaced or at appropriate points within the length of the original pipeline. Pits shall be centered over the original sewer line. The Contractor shall indicate the locations of all pits required in his bid. The number of pits shall be the minimum necessary to most effectively accomplish the work. Where manholes are used as machine or new pipe insertion pits, the Contractor shall state any modifications required to manholes, prior to beginning work. Rehabilitation of manholes used as pits shall be considered incidental to the pipe replacement.

4. Process Limitations: Though the installation process may be licensed or proprietary in nature, the Contractor SHALL NOT change any material, thickness, design values or procedures stated or approved in the submittals without the Engineer's prior knowledge and approval. It shall be the Contractor's responsibility to comply with the specifications in these specifications and the manufacturer's procedures.
I. SEALING AND BENCHES IN MANHOLES

1. No sealing operation shall begin until the pipe liner has relaxed and adjusted to the surrounding ground temperature. The minimum relaxing period shall typically be 12 hours.

2. The replacement pipe shall be installed with a tight fitting seal with the existing or new manholes. The manhole seals shall be submitted and approved by the Engineer prior to use. A non-shrinking grout shall be applied circumferentially around the seal and the replacement pipe to prevent inflow at the manhole.

3. The top half of the pipe within the manhole shall be neatly cut off and not broken or sheared off, at least four inches away from the manhole walls. The channel in the manhole shall be a smooth continuation of the pipe and shall be merged with other lines or channels, if any. The side of the channels shall be built up with mortar/concrete to provide benches at a maximum of 2 in 12 pitch toward the channel.

J. OBSTRUCTION REMOVAL

1. In the event that an obstruction is observed during the pre-installation video which cannot be removed with conventional sewer cleaning equipment, and open excavation point repair shall be made to correct the obstruction. The point repair shall consist of replacing an assumed length of ten feet (10') of the existing pipe in accordance with Section "Sanitary Sewer Construction". Additional pipe replacement may be required. Payment shall be as made based upon the measured footage agreed by the Contractor and the Engineer. All pavement removal, replacement, trenching, backfill, and other items as necessary to make the point repair shall be incidental to the cost of the individual repair.

K. SEWER SERVICE LATERALS AND CONNECTIONS

1. Existing service connection shall be located and exposed before initiating sewer main replacement operations. All service laterals attached to the existing sewer shall be completely disconnected and isolated from the existing sewer before the trenchless replacement operation. Service laterals shall not be reconnected to the new sewer line until replacement and testing are completed. Any services remaining off line for an extended period of time, or any connections as deemed necessary by the Engineer to protect that customer, shall be bypass pumped until such time that they can be reconnected.

2. Connection of the new service lateral to the sewer main shall be accomplished by use of watertight, compression-fit, or saddle service
connection. The service connection shall be specifically designed for connection to the type of sewer main being installed.

3. Once connection of the service lateral has been completed, the area surrounding the connection area, as well as underneath the lined main, shall be encased in concrete. All service connections shall be visually inspected and accepted by City Utility staff prior to backfill.

4. Payment for replacement/reconnection of service laterals shall be at the unit price for each as outlined in the Bid Proposal and shall include all labor and materials, excavation, location of service, dewatering, backfill, compaction, pavement removal and replacement.

L. TESTING OF REPLACEMENT PIPE

1. After a manhole-to-manhole section of the sanitary sewer main has been replaced and prior to any service lines being connected to the replacement pipe, the pipe shall be tested according to the testing procedures in Section "Sanitary Sewer Construction". Any section that fails the test(s) shall be repaired and retested by the Contractor until the leakage is within the allowable limits.

3.1 CURE IN PLACE PIPELINE METHOD (CIPPM)

The CIPP method is defined as the rehabilitation of gravity sewer pipe by the installation of a liner pipe inside the cavity of the existing pipe which when processed, forms a new pipe of slightly smaller dimension with equal to or greater specifications than the existing pipe. The liner pipe shall have no cavity between itself and the host pipe.

A. The method utilizes heat and pressure processing to reform the shape of liner pipe into a round shape to accomplish a fit between the host pipe and liner pipe. The liner shall function either as a new pipe within a pipe and/or a liner pipe.

B. A cable shall be strung through the host pipe and attached to the deformed pipe. The flexible pipe shall be pulled through the existing conduit. The deformed pipe shall not be damaged during installation.

C. Proper guiding rollers and sleeves shall be provide for insertion and protection of the deformed pipe. And upstream manhole shall be the point of entry and the downstream manhole shall be the point of termination.

D. Once the deformed pipe is in place, the pipe shall be processed according to manufacturers recommendations and procedures to constitute completion of the liner pipe installation.
E. Plan of Operations: Prior to the pre-construction conference, the contractor shall submit a plan indicating the sequence of operations for EACH liner section. The Contractor shall not be allowed to start any construction activities until his plan of operation has been approved by the Engineer.

F. Materials

1. Liner Pipe: The liner pipe shall be manufactured from a high density high molecular weight polyethylene resin which conforms to ASTM D-1928 and meets the requirements for Type III, Class B, Grade P34, Category 5, and has as PPI rating of PE 3408, when compounded. The pipe produced from this resin shall have a minimum cell classification of 345434D or E under ASTM D3350.

At the time of manufacture, each lot of liner shall be inspected for defects and tested in accordance with ASTM D-2837 and D-1693. At the time of delivery, the liner shall be homogeneous throughout, uniform in color, free of cracks, holes, foreign materials, or deleterious faults.

The liner shall be marked at 5 foot intervals or less with a code number which identifies the Manufacturer, SDR, size, materials, date and shift on which the liner was extruded.

2. Clamps: Clamps for liner pipe connection at excavations between two manholes shall be all stainless steel, full circle universal clamp couplings with a 1/4 inch min. thickness, and a grid type gasket. Minimum clamp width for 8-inch nominal pipe shall be 18 inches.

G. PRE-INSTALLATION

The contractor shall submit a work plan to the Engineer for review and acceptance. The work shall address the following minimum preparation steps, unless approved otherwise by the Engineer.

1. Pre-Installation Television Inspection: It shall be the responsibility of the Contractor to video (TV) inspect the sewer pipe before the CIPPM. This inspection shall be incidental to the installation of the liner pipe. A video tape suitable log shall be kept for later reference by the Owner. This inspection shall for, but not limited to, the following purpose.

   a. To assure that existing pipe conditions are acceptable for CIPPM.

   b. To locate all active service line connections.
c. To identify and locate any line obstructions that cannot be removed by conventional sewer cleaning equipment, which would prevent/hinder the CIPPM process.


d. To verify the existing condition of parallel lines in the event of potential damage during the CIPPM process.

2. Bypassing Sewage: When required for acceptable completion of the CIPPM process, the contractor shall provide for continuous sewage flow around the section(s) of pipe designed for the installation of liner pipe. The pump bypass lines shall be of adequate capacity and size to handle the flow, and the contractor shall submit a detailed narrative of the bypass plan to the Engineer prior to the CIPPM process.

3. Line Obstructions: If pre-installation video (TV) inspection reveals an obstruction in the existing sewer which will prevent completion of the CIPPM process, and that cannot be removed by conventional sewer cleaning equipment, then a point repair shall be made by the contractor, with the approval of the Engineer.

4. Sags in Line: If pre-installation video (TV) inspection reveals a sag in the existing sewer that is greater than one-half the diameter of the existing pipe, it shall be the contractor's responsibility to install the liner pipe to result in an acceptable grade without the sag. The contractor shall take the necessary measures to eliminate these sags by the method of: pipe liner, digging a sag elimination pit and bringing the existing pipe trench to a uniform grade in line with the existing pipe or by other measures. If required, this shall be considered as a point repair.

H. INSTALLATION

1. After the existing sewer pipe has been inspected by video camera and the service laterals recorded, a cable shall be strung through the existing pipe and attached to the liner through an existing manhole or access point. The liner shall be pulled through the existing manhole or access point, and the existing pipe with care to prevent damage to the deformed pipe.

2. When the deformed pipe is in place, it shall be cut and the processing manifolds shall be attached in and secured at both ends of the pipe. The temperature and pressure measuring instruments shall be attached to the deformed pipe at both ends.

3. Through the use of steam and air pressure, the deformed pipe shall be progressively reformed to conform to the existing pipe walls. The deformed pipe shall be pressurized, while the termination point valves
are kept open to provide even heat flow. The condition of the existing pipe and the expected rehabilitation shall determine the optimum pressurization level to be used to obtain the best results.

4. When the temperature reduces to 100 degrees Fahrenheit the contractor shall then slowly raise the pressure to maximum of 33 psi (or best pressure) while applying air for continued cooling. The equipment shall be disconnected after ambient temperature is attained.

5. All temperatures and pressures shall be monitored throughout the installation process to ensure that each phase of the process is achieved at the approved Manufacturer's recommended pressure and temperature levels.

I. SEALING AND BENCHES IN MANHOLES

A. No sealing operation shall be required with this type of method unless the Engineers shall require them for a specific situation. See section 2.9.B.

B. The liner pipe shall be installed with a tight fitting seal on only new manholes. The manhole seals shall be submitted and approved by the Engineer prior to use. A non-shrinking grout shall be applied circumferentially around the seal and the liner pipe to prevent inflow at the manhole.

C. The top half of the pipe within the manhole shall be neatly cut off and broken or sheared off, at least four inches away from the manhole walls. The channel in the manhole shall be a smooth continuation of the pipe and shall be merged with other lines or channels, if any. The side of the channels shall be built up with mortar/concrete to provide benches at a maximum of 2 in 12 pitch toward the channel.

J. OBSTRUCTION REMOVAL

1. In the event that an obstruction is observed during the pre-installation video which cannot be removed with conventional sewer cleaning equipment, and open excavation point repair shall be made to correct the obstruction. The point repair shall consist of replacing an assumed length of ten feet (10') of the existing pipe in accordance with Section "Sanitary Sewer Construction". Additional pipe liner may be required. Payment shall be as made based upon the measured footage agreed by the Contractor and the Engineer. All pavement removal, replacement, trenching, backfill, and other items as necessary to make the point repair shall be incidental to the cost of the individual repair.
K. SEWER SERVICE LATERALS AND CONNECTIONS

1. Existing service connection shall be located and recorded on video camera and in a logbook prior to operations. All service laterals attached to the existing sewer shall remain connected during the curing process. Only after the new pipe liner has been installed, cooled, and tested according to the testing procedures in the Section "Sanitary Sewer Construction" shall the contractor begin reinstating the existing service connections. Any services remaining off line for an extended period of time, or any connections as deemed necessary by the Engineer to protect that customers, shall be bypass pumped until such time that they can be reinstated.

2. Reinstating of the service lateral(s) to the sewer main shall be accomplished by use of remote control unit working from within the new pipe liner. The service line opening shall be drilled, augered, rimmed with the remote controlled tool so that the opening is no less that 95 - 96% open. If the remote control unit cannot open the service line connection to the above specification then the contractor shall excavate the service connection and install a new watertight, compression-fit, or saddle service connection. The service connection shall be specifically designed for connection to the type of sewer pipe liner being installed.

3. If the sewer lateral connection must be excavated, the area surrounding the connection area, as well as underneath the lined main, shall be encased in concrete. All service connections shall be visually inspected and accepted by City Utility staff prior to backfill.

4. Payment for replacement/reconnection of service laterals shall be at the unit price for each as outlined in the Bid Proposal and shall include all labor and materials, excavation, location of service, dewatering, backfill, compaction, pavement removal and replacement.

L. TESTING OF LINER PIPE

A. After a section of no more than 600' feet has been lined and prior to any service lines being reinstated to the liner pipe, the pipe shall be tested according to the testing procedures in Section "Sanitary Sewer Construction". Any section that fails the test(s) shall be repaired and retested by the Contractor until the leakage is within the allowable limits.