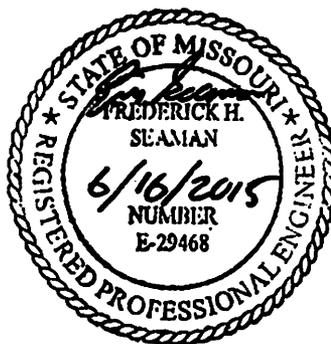


CITY OF JEFFERSON

STANDARD SANITARY SEWER SPECIFICATIONS



REVISED 2015

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STANDARD SANITARY SEWER SPECIFICATIONS

SS-1.0 GENERAL

SS-1.1 Description: Sanitary sewer construction shall consist of furnishing all labor, materials and equipment for the complete installation of sewers and appurtenances in accordance with the City Standard Drawings, Plans, General Provisions and Covenants, Street Specifications and Standards, and these Specifications.

SS-1.2 Specification Modifications: It is understood that throughout this section these specifications may be modified or deleted by appropriate items in the Special Provisions or notes on the contract drawings.

SS-1.3 Revisions of Standards: When reference is made to a Standard Specification (ASTM, AWWA, State of Missouri Code of State Regulations (CSR)) the specification referred to shall be understood to mean the latest revision of said specification as amended at the time of the Notice to Bidders, except as noted on the Plans or in the Special Provisions.

SS-2.0 MATERIALS AND TESTING

SS-2.1 Scope: This section governs the furnishing of all pipe, fittings and other materials as required to complete the work as shown on the Plans and as provided for in the Special Provisions. The materials specified are to be used under normal conditions. Vitriified clay, HDPE, and fiberglass reinforced pipe may be approved on a case-by-case basis for special applications if installed by manufacturer's recommendations.

SS-2.2 General:

- a. Requirements: Furnish pipe of materials, joint types, sizes, and strength class indicated and specified. Higher strengths may be furnished at Contractor's option, at no additional cost to the Owner.
- b. Manufacturer: The manufacturer shall be experienced in the design, manufacture and commercial supplying of the specific material.
- c. Inspection and Testing: To be performed by the manufacturer's quality control personnel in conformance with applicable standards. Testing may be witnessed by Owner, Engineer, or approved independent testing laboratory. Upon request of the

Owner, and prior to delivery, the Contractor shall provide three (3) copies of certified test reports indicating that material does conform to the specifications.

SS-2.3 **Ductile Iron Pipe:** Conform to ANSI A21.51, except as otherwise specified herein.

- a. **Design:** Design of pipe shall be in accordance with ANSI A21.50 laying conditions B or F. Minimum wall thickness shall be for Class 2.
- b. **Joints:** Mechanical and push-on joints for ductile iron pipe and fittings shall conform to the requirements of ANSI A21.11.
- c. **Gaskets** shall be neoprene or other synthetic rubber material. Natural rubber gaskets will not be acceptable. Gaskets shall be rated for intended use (gravity sewer or pressure main).
- d. **Fittings:** Fittings shall be in accordance with ANSI A21.10 and shall have a pressure rating of not less than that specified for pipe. Fittings used with ductile iron pipe shall be ductile iron. Fittings for pipe with mechanical joints shall have mechanical joints. Fittings for pipe with push-on joints shall be either mechanical joint or push-on joint.
- e. **Lining:** Polyethylene in accordance with ANSI/ASTM D 1248 or two component epoxy per manufacturer's recommendations. Cement-mortar lining is not acceptable.
- f. **Coating:** Bituminous per manufacturer's recommendations.
- g. **Furnish all specials, taps, plugs and wall fittings as required.**

SS-2.4 **Poly Vinyl Chloride (PVC) Sewer Pipe:** Conform to ASTM D-3034 for pipe 15-inch and less and ASTM F679 for sizes 18-inch and greater,. Building sewer (lateral) pipe is specified in the City Plumbing Code.

- a. **General:** Furnish maximum pipe lengths manufactured by the supplier, except fittings, closures and specials.
- b. **Design:** The minimum wall thickness for PVC Pipe shall conform to SDR-35. Pipe bedding shall conform to ASTM D-2321 for Class I materials. For deep excavations (over 12 feet) consideration should be given for pipe of greater wall thickness (SDR26 or greater).

- c. Joints: Flexible gasketed joints shall be compression type with a gasket confined in either the spigot end or the bell end of the pipe. Rubber gasket rings shall conform to the requirements of ASTM D-1869. Gaskets shall be neoprene or other synthetic material. Natural rubber gaskets will not be acceptable.
- d. Fittings: Fittings defined as tee connections suitable for assembly to 4-inch or 6-inch house or building sewers connection to existing sewer mains shall be saddle-type fittings of PVC Plastic. Connections to new or inactive sanitary sewers shall be with wye fittings.

SS-2.5

Sanitary Sewer Forcemain: Shall be PVC and conform to the requirements of ANSI/AWWA C900-89. Pressure Class 200.

- a. Bends in sanitary sewer forcemain shall be by restrained joint ductile iron fittings restrained in accordance with manufacturer's recommendations. Sanitary sewer forcemain shall be installed with locating tracer wire. Tracer wire shall be insulated THNN, 12 gauge copper wire. All wire shall be joined by use of wire clamps. These connections shall be sealed and taped to create a watertight connection. Tracer wire shall be secured to the top of the main by tape a minimum of 3 times in each standard length of pipe. Tracer wire shall be looped to the top of valve boxes for access and at ends for conductivity.
- b. Where sanitary sewer forcemains must cross watermains, the forcemain shall be installed below the watermain with not less than an 18 inch separation. Forcemains must also maintain a 10-foot horizontal separation from water mains measured pipe edge to pipe edge. Where this separation is not possible, alternatives must be approved by the Engineer and shall adhere to 10 CSR 8.120 (10) (C).
- c. Buried gate valves on forcemains two (2") inch through twelve (12") inch inclusive shall be Mueller Gate Valves, mechanical joint, resilient seated wedge disk or equal. Valve shaft shall have an "O" ring seal with a two (2") inch square operating nut. Valve shall open in a counter-clockwise direction. Buried gate valves shall have valve boxes which shall be two-piece, twenty-four (24") inch, screw type, bottom section and sixteen (16") inch screw type, top section with lid marked "SEWER".

SS-2.6

Reinforcing Steel: Reinforcing steel shall be placed as shown on the Plans and shall conform to ASTM Specifications as follows:

- a. Bars and rods shall be deformed billet-steel conforming to ASTM A-615, Grade 40.
- b. Welded wire fabric shall conform to ASTM A-185, Grade 40.
- c. Fabricated steel bar and rod mats shall conform to ASTM A-184. Bar material shall conform to ASTM A-615, Grade 40.
- d. Smooth bars shall be round carbon steel bars conforming to ASTM A-306, Grade 60.

SS-2.7

Manhole Materials:

- a. General: Manholes shall conform to the applicable City Standard Drawing. All new manholes must be precast as defined in these specifications and applicable City Standard Drawings.
- b. Brick and mortar manholes: Repair to existing brick manholes use materials as follows:
 - 1. Mortar: Mortar and plaster casting for masonry manhole units shall be two parts Portland Cement to one part Masonry Cement to six parts plaster sand mixed with the least amount of potable water necessary to provide a workable mortar.
 - 2. Brick: Clay brick shall conform to ASTM C-32, Grade SS or SM. For Grade SM, the maximum water absorption by 5-hour boiling shall not exceed 12.0 percent for individual brick or 9.0 percent for the average of five bricks.
- c. Precast Concrete: Precast concrete manholes shall conform to ASTM C-478. Joints shall be of material as specified for reinforced concrete pipe joints or a bitumastic material or performed flexible joint sealants applied in accordance with manufacturer's recommendations.
- d. Cast in Place Concrete: Concrete used shall conform to applicable City Standard Drawing.
- e. Waterproofing: Waterproofing will be required to all manholes. The bitumen shall consist of two coats of asphalt or coal-tar pitch, H.B. Tnemecol (Coal Tar) Series 46-465 or equal. Asphalt shall conform to the requirements of ASTM D-449. Coal-tar pitch shall conform to the requirements of ASTM D-450.

- f. Flexible connectors designed to produce a positive watertight connection for pipes entering precast manholes shall be provided. These connectors shall be the "A-LOK" produced by A-LOK Products, Inc. or approved equal.
- g. Interior coating: Where manholes are subject to excessive hydrogen sulfide exposure, the City requires manholes be lined with a one-part urethane Tnemec Series 434 Perma-Shield H2S or equal. Interior coating shall be applied prior to delivery to the site and touched up where necessary.

SS-2.8 Manhole Castings:

- a. General: Cast-iron rings, covers and steps conform to the applicable City Standard Drawings. The castings shall meet or exceed the following requirements:
- b. Iron Castings:
 - 1. Iron castings shall conform to the requirements of ASTM A-48, Class 30.
 - 2. Castings shall be clean and whole, and without blow or sand holes or any other surface defects which would impair serviceability. Plugging or filling of holes or other defects will not be permitted.
 - 3. Parting fins and pouring gates shall be removed.
 - 4. Castings shall be thoroughly cleaned and painted with two coatings asphaltum paint before being delivered to the site.

SS-2.9 Bedding Aggregate: All materials used for crushed stone pipe bedding shall conform to applicable City Standard Drawings.

SS-2.10 Water Stops: Water stops must be installed in accordance with City Standards.

SS-3.0 GRADING AND SITE PREPARATION

SS-3.1 Scope: This section governs the furnishings of all labor, equipment tools, materials, and the performances of all work for clearing, grubbing, and demolition, wholly or in any part, at locations shown on the Plans, or as provided for in the Special Provisions. Clearing, grubbing and demolition

shall be done only to that extent which is necessary for the prosecution of the construction of the sewers.

SS-3.2

Definitions:

- a. **Clearing:** Clearing shall consist of removing all vegetable matter, such as trees, brush, down timber, rotten wood, rubbish and other objectionable combustible materials, found on or above the surface of the site. It may include removing fences, lumber, waste dumps and trash, and the salvaging of such of the materials as may be specified. This item shall include the disposal of the debris resulting from the clearing operations.
- b. **Grubbing:** Grubbing shall consist of removing and disposing of stumps, roots, buried trees and brush, wood piling, wood curb planking, wood culverts, wood catch basins and drains, and wood stairs appearing on or below the surface of the ground which has not been included in section entitled "Clearing".
- c. **Demolition:** Demolition shall consist of demolishing, removing, disposing, or incorporating into backfill all non-vegetable matter appearing above, on, or below the ground surface. This shall include all material derived from the demolition of Portland Cement Concrete items such as base courses, curbs, curb and gutters, sidewalks, floors, steps, driveways, drainage structures of all sorts, fences, and other miscellaneous items such as foundations or wall of any sort, and iron or steel items, and shall include all asphaltic items such as pavement and base courses.

SS-3.3

Construction Details:

- a. **Limits of Work:** The limits for clearing, grubbing and demolition shall, in no case, extend beyond the limits of the right-of-way, city property lines, or easements, unless otherwise specified on the Plans or Special Provisions.
- b. **Protection of Existing Facilities:** The Contractor shall be responsible for protecting any improvement of any agency, public or private, in the vicinity of clearing, grubbing or demolition operations. When necessary the Contractor shall enlist the assistance of the affected agencies in the location of their facilities. The Contractor will not be responsible for the cost to any agency for assistance in the location of its facilities, but he shall be responsible for the cost of all damages to such facilities arising because of his carelessness or negligence.

1. **Private Sewer Facilities:** The Contractor shall make every reasonable effort to protect private sewer facilities. They are not shown on the Plans. When these facilities are disturbed or damaged by the work, the Contractor shall make necessary repairs to the facilities for continuous service prior to the close of the work day.
2. **Property Pins:** All property or lot corner pins or stakes shown on the Plans and disturbed by this construction will be properly referenced by the Contractor prior to removal, and reset by the Contractor upon completion of the project.

SS-3.4 **Clearing:** Clearing shall be performed in advance of the construction operation so as not to delay the progress of the work. The refuse resulting from clearing shall be hauled to a waste site secured by the Contractor, or if permitted by the Special Provisions may be burned in the area indicated on the Plans in such a manner as to meet all applicable requirements of the Federal, State, County and Municipal regulations concerning health, safety and public welfare.

SS-3.5 **Grubbing:** Grubbing shall be kept abreast of the "Clearing" as nearly as the sequence of operations may permit. All stumps, roots, and other objectionable material within the disturbed area shall be removed to a depth of at least twelve (12) inches below the finished grade elevation. Disposal of debris from grubbing shall be as described in "Clearing" above.

SS-3.6 **Demolition:** If portions of existing improvements are to be left in place, the limits of pavement removal shall be laid out as neat, straight lines a minimum distance of six (6) inches beyond the anticipated edges of excavation. If the pavement removal limits are approximately parallel to and three (3) feet or less from an existing pavement joint, previous cut, or curb, the limits of removal shall be extended to the joint, cut, or curb. Sufficient portions of the pavement shall be removed to provide for the proper grade and alignment of the new construction. Disposal of debris from demolition shall be described in SS-3.4 "Clearing".

SS-3.7 **Environmental Protection Procedures:**

- a. **General:** Contractor shall take all measures to minimize disturbed areas. Compliance with the following procedures for protection of existing greenery is required.
- b. **Trees:** All reasonable effort shall be made to save as many trees as possible. If trees can be saved by trimming, this shall be done in accordance with acceptable pruning practices. Any tree removed

shall be replaced with like species of nursery stock outside the temporary Sewer Right-of-Way.

All trees within 30 feet of either side of sewer centerline which are specifically to be removed or saved have been marked on the Plans with the following notations.

1. Trees marked "S" shall be saved.
 2. Trees "Xed" out shall be removed.
- c. **Shrubbery, Small Plants and Flowers:** Prior to the start of construction, property owners will be notified of the proposed starting date. One purpose of this notification is so that the property owners may remove any shrubbery, small plants or flowers that they, the property owners, desire to save.

SS-4.0 PIPE LAYING, JOINTING AND TESTING

SS-4.1 Scope: This section governs the furnishing of all labor, equipment, materials and tools for the installation of all pipes, fittings, specials and appurtenances as shown on the Plans, City Standard Drawings or as provided for in the Special Provisions.

SS-4.2 Handling:

- a. Handle pipe materials and fittings in a manner to insure installation in sound and undamaged condition. Do not drop or bump. Use slings, lifting lugs, hooks, and other devices designed to project pipe, joint elements and coatings. In handling plastic pipe of ten (10) feet in length or greater, a double sling will be required unless otherwise approved by the Engineer.
- b. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.

SS-4.3 Installation:

- a. All work shall be in accordance with the following standards:

ASTM D-2321 - Underground installation of flexible Thermoplastic Sewer Pipe.

AWWA C-600 - Installation of Cast Iron Water Mains.

b. Utilize equipment, methods and materials insuring installation to lines and grades indicated.

1. **Laser:** The Contractor shall provide and maintain in good working order, on the site, at all times, a laser beam a laser beam is used to control line and grade for the pipe laying operation, the laser must be checked at the beginning of each day and at least once between manholes and at any other time the Engineer deems necessary to insure the proper line and grade of the pipe.

Maintain the following tolerances from true alignment and grade:

Alignment	3 inches
Grade	1 inch

Joint deflection shall not exceed the maximum allowable deflection per joint according to ASTM C-425, ASTM C-594 and AWWA C-600. Only one correction for alignment and/or grade shall be made between adjacent manholes.

2. Except where pipe sections are being encased in concrete, no pipe is to be supported by blocks.
3. All transition in sewer main line, pipe size and grade must be within a manhole.
4. Curvilinear alignment of sewers for diameters over 24-inches can be considered by the Engineer on a case-by-case basis subject to 10 CSR 20-8.120.

c. Install pipe of size, material, strength class, and joint type with embedment as shown on the Plans.

Reinforced concrete pipe with elliptical reinforcement shall be installed and positioned in accordance with the pipe manufacturer's pipe markings indicating top and bottom pipe.

Where velocities greater than 15 feet/second are attained, special provisions shall be made to protect against displacement by erosion and impact.

d. Pipes installed on grades in excess of 20% shall be anchored securely with concrete anchors spaced as follows:

<u>Grade</u>	<u>Maximum Anchor Spacing</u>
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20% - 35%	36 ft.
35% - 50%	24 ft.
greater than 50%	16 ft.

- e. Insofar as possible, commence laying at downstream end of line and install pipe with spigot or tongue end downstream.
- f. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation. Close open ends of pipe with snug fitting closures. Include provisions to prevent flotation should water control measures prove inadequate. Water entering the trench shall be removed in accordance with USCoE and MDNR permits until the work is completed. The sewer shall not be used to transport trench water, rock or debris. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.
- g. Install pipe only when weather and trench conditions are suitable. Do not lay in water. Brace or anchor pipe as required to prevent displacement after establishing final position.
- h. Sewers built adjacent to or crossing streams shall be in accordance with 10CSR 20-8.120(8)
- i. Protection of water supplies: Sewer mains shall be installed a minimum horizontal distance of 10-feet from water mains measured pipe edge-to-edge. Sewer mains shall also be installed a minimum vertical distance of eighteen inches between the outside of the water main and the outside of the sewer main. Where these separations are not possible, alternatives must be approved by the Engineer and shall adhere to 10 CSR 8.120 (10) (C).

SS-4.4

Pipe Bedding, Haunching and Initial Backfill: The sewer trench shall be carried to a point not less than four (4) inches below bottom of pipe bell. Crushed stone bedding, compacted to full width of trench, shall than be placed and compacted to bottom of pipe with proper allowance for bell joints. After each length of pipe being laid has been shoved "home" and placed in proper alignment, it shall be securely anchored and held in position by crushed stone deposited simultaneously on each side of the pipe. This crushed stone backfill shall extend to a point not less than six (6) inches above the top of the pipe bell. If unstable conditions are encountered and it is determined by the Engineer that the bedding specified will not provide suitable support for the pipe, additional excavation to the limits determined by the Engineer will be required. This additional excavation shall be backfilled with crushed stone material approved by the Engineer.

a. Rigid pipe. Bedding Classes A, B,C, or crushed stone, as described in ASTM C12, shall be used and carefully compacted for all rigid pipe provided the proper strength pipe is used with the specified bedding to support the anticipated load based on the type of soil encountered and potential groundwater conditions.

b. Ductile iron pipe. Embedment materials for bedding and initial backfill, as described in ASTM A746 for Type 1 through Type 5 laying conditions, shall be used for ductile iron pipe provided the proper strength pipe is used with the specified bedding to support the anticipated load based on the type of soil encountered and potential groundwater conditions.

c. Plastic pipe. Embedment materials for bedding, haunching, and initial backfill, Classes I, II, or III, as described in ASTM D2321, shall be used and carefully compacted for all flexible pipe provided the proper strength pipe is used with the specified bedding to support the anticipated load based on the type of soil encountered and potential groundwater conditions.

d. Composite pipe. Except as described in ASTM D2680, the bedding, haunching, and initial backfill requirements for composite pipe shall be the same as for plastic pipe

SS-4.5 Jointing:

a. General Requirements:

1. Locate joints to provide for differential movements at changes in type of pipe embedment, concrete collars, and structures. Support pipe from wall of manhole to first joint in normal sewer trench with concrete cradle structurally continuous with base slab or footing.
2. Clean and lubricate all joint and gasket surfaces with lubricant recommended by pipe manufacturer.
3. Utilize methods and equipment capable of fully homing or making up joints without damage.
4. Check joint opening and deflection for specification limits.
5. Examine each piece of pipe prior to installation for soundness and specification compliance.

b. Provisions for Jointing Concrete Pipe: Check gasket position and condition after assembly with feeler gauge prior to installation of next section.

c. Provisions for Jointing Cast Iron and Ductile Iron Pipe:

1. Conform with AWWA C-600.
2. Paint suspected damaged portions with turpentine and dust cement to check for cracks. Remove turpentine and cement by washing when crack test is satisfactorily completed. If cracks are found, the pipe shall be rejected.
3. Check gasket position and condition after assembly prior to installation of next pipe section.
4. Rubber Gasketed Joints: Check gasket position and condition after assembly with feeler gauge prior to installation of next section.
5. Provisions for Jointing RPM Pipe: Check gasket position and condition after assembly prior to installation of next pipe section.
6. Provisions for Jointing PVC Pipe: Check gasket position and condition after assembly prior to installation of next pipe section.

SS-4.6 Cutting: Cut in neat workmanlike manner without damage to pipe. Observe specifications regarding joint locations. Smooth cut by power grinding to remove burrs and sharp edges. Repair lining as required and approved.

SS-4.7 Temporary Plugs:

1. Plugs: Provide and install plugs as manufactured by pipe supplier or as fabricated by Contractor if approved. Plugs shall be watertight against heads up to twenty (20) feet of water. Secure plugs in place in a manner to facilitate removal when required to connect pipe.
2. Location: Plugs shall be installed as specified or where shown on Plans. Also the open end of the sewer shall be plugged at the end of the work day with a suitable mechanical plug to prevent entry of foreign material until work is resumed.

SS-4.8 Connections to Existing Pipelines and Structures:

- a. Connect pipe to existing structures and pipelines where indicated. Observe pertinent articles of specifications pertaining to joint locations.

- b. Prepare structure by making an opening with at least two (2") inches clearance all around fitting to be inserted. Connector gasket shall be placed on pipe. Pipe shall be positioned in manhole wall prior to grouting. Opening between pipe and manhole shall be filled with an expansive grout in such a manner that a watertight condition will result.
- c. Manholes to be built on an existing sewer shall be constructed in such a manner as will not disturb services of existing sewer. The manhole base, walls and invert shall be completed before the top half of the sewer pipe is cut or broken away. Rough edges of the pipe thus exposed shall be covered with expansive grout, in such a manner as to produce a smooth and acceptable finish. Any portion of the existing sewer damaged by the Contractor shall be repaired at no expense to the City.
- d. Connections between different pipe materials shall be made using proprietary transition coupling unless otherwise specified on the Plans.
- e. Service connections to sewer mains are governed by the City Plumbing Code. Provisions include: Service connections to the sewer main shall be watertight and not protrude into the sewer. Service Saddles are approved on a case-by-case basis and if used, it shall be a device designed to join with the types of pipe which are to be connected. All materials used to make service connections shall be compatible with each other and with the pipe materials to be joined and shall be corrosion proof.

SS-5.0 MANHOLES AND SPECIAL STRUCTURES

SS-5.1 Scope: This section governs the furnishing of all labor, equipment, tools and materials, and the performance of all work incidental to the construction of manholes, drop manholes and special sewer structures complete with covers, steps, fittings and appurtenances as required in accordance with the Plans, Special Provisions, and City Standard Plans.

SS-5.2 General: As used herein special structures refers to manholes on large sewers, special junction structures, metering stations, siphons and similar structures constructed on the pipeline. Manholes and special structures may be constructed of precast concrete sections, cast-in place concrete on existing mains or where space does not permit a precast manhole.

SS-5.3

Construction:

- a. **General:** Manholes and special structures shall be constructed at locations indicated and in accordance with details as shown on the Plans or City Standard Drawings.
- b. **Precast Wall and Reducing Cone Sections:** Handle with care to avoid damage to joint ends of each section. Damaged sections may be subject to rejection at the discretion of the Engineer. When using O-ring joints, care shall be exercised in placing the O-ring on the spigot end, and lowering the bell section on to the spigot end so that a watertight seal is obtained.

When using bitumastic joints both spigot and bell ends shall be primed with solvent material compatible to the adhesive in the mastic. Approved bitumastic material shall completely fill the joints so that a minimum of one-fourth inch bead of material is visible after jointing, to be smoothed off after completion of the jointing operation.

When a flexible preformed butyl rubber or bituminous polymer compounded with modifiers is used to seal jointed sections of manholes, the extrusion of sealant from the joint is not required. The vertical spacing between manhole sections shall not exceed one-fourth inch. Preformed joint sealers remain flexible at temperatures as low as 0 degrees Fahrenheit.

All bitumastic materials or preformed flexible joint sealants shall not be applied to wet or damp surfaces.

- c. **Cast-in-Place:** Consolidate concrete with mechanical vibrators to eliminate entrapped air voids and rock pockets. Forms shall be supported in such a manner as to prevent any movement of the forms while concrete is being cured. Any movement of the forms may be cause for rejection.
- d. **Invert Channels:** Pipes must discharge into channels. Dishcharge onto benches is not allowed. Alignment of the invert channels shall be as shown on the Contract Drawings. When no specific details and dimensions are given, changes in flow direction shall be smooth, uniform and made with the longest radius possible. The cross section shape of invert channels shall match the lower halves of the entering and exiting pipes. The surfaces of the channels shall be steel-troweled to produce a dense, smooth surface. When filling openings around pipes through manhole walls, mortar and/or masonry units shall be placed so that the resulting joints are

watertight. Mortar used in the joint closure shall not interfere with the invert channel.

SS-5.4 **Curing:** Cast-in-place concrete shall be adequately protected from freezing and loss of moisture for the first 24 hours. The curing methods and materials to be used shall be approved by the Engineer.

SS-5.5 **Manhole Rings:** All rings for manhole covers shall be set to match the existing surfaces, except in flood plains where the Plans indicate that the ring is to be set at an elevation higher than existing ground. Each ring shall be set on a full mortar bed of bitumastic material, if approved by the Engineer. If masonry units are used to adjust rings to grade, the masonry work shall conform to Section SS-5.3 (d) of these specifications.

SS-5.6 **Waterproofing:** Two coats of an asphalt or coal-tar pitch waterproof coating shall be applied to the exterior of all structures from base to manhole ring. The coating shall be applied in sufficient quantity so that no bare or thin spots show. The coating shall be applied in sufficient time to permit proper curing prior to backfilling the excavation. Proper methods and materials shall be used during backfilling to prevent damage to the coating. Any damage to the coating which does occur shall be immediately repaired.

Where manholes may be flooded street runoff or high water, the Engineer will specify gasketed or bolt-down manhole covers.

SS. 5.7 **Manhole Installation near water ways:** Manholes shall be located and installed so that they do not interfere with the free discharge of stream flood flows.

SS. 5.8 **Manhole Installation near water mains:** Manholes shall be installed a minimum distance of 10-feet from any existing or proposed water mains. Where this separation is not possible, alternatives must be approved by the Engineer and shall adhere to 10 CSR 8.120 (10) (C).

SS-6.0 **PIPE ENCASEMENT , COLLARS AND AERIAL SEWERS**

SS-6.1 **Scope:** This section governs the furnishing of all labor, equipment, tools and materials, and the performance of all work for the encasement of pipe in concrete or installation of concrete collars at locations shown on the Plans.

SS-6.2 **General:** Tools or partial encasement of pipe in concrete shall be used where the required safe supporting strength cannot be obtained by other bedding methods. Concrete encasement shall also be provided at locations to protect public water supplies or where there exists the possibility that

standard bedding may be eroded by currents of water under and around the pipe.

SS-6.3

Materials:

- a. **Concrete:** Concrete whether reinforced or nonreinforced shall be approved by the Engineer.

Reinforcing: Reinforcing steel used in concrete encasements shall be ASTM A-615, Grade 40.

SS-6.4

Construction: Concrete encasement shall be constructed at locations indicated and in accordance with details as shown on the Plans or City Standard Drawings. Start and terminate encasement at a pipe joint. Suitably support and block pipe to maintain position and prevent flotation. Form to dimensions indicated or construct full width of trench.

- a. **Joints:** If a single section of encasement is not constructed continuously (concrete is not placed in a single deposit) construction joints shall be provided in the encasement to coincide with pipe joints. Construction joints shall be keyed continuously around the encasement. Longitudinal reinforcement shall be continuous through construction joints.
- b. **Curing:** Concrete encasement shall be protected and cured so as to prevent excessive evaporation of moisture or freezing.
- c. **Backfilling:** Backfill trench only after concrete encasement has obtained a minimum of 2000 psi and can sufficiently support the loads imposed by backfill and backfill operations.

SS - 6.5 Aerial sewers are considered only on a case-by-case basis and must conform to 10CSR 20-8.120(9)

SS-7.0 **BACKFILL**

SS-7.1

Scope: This section governs the furnishings of all labor, equipment, tools and materials, and the performance of all operations necessary for the proper replacement of backfill material in pipe trenches and around structures as required by the Plans and Special Provisions.

General:

- a. Unless otherwise specified, all sewer trenches and excavation around structures shall be backfilled to the original surface of the

ground with earth, earth and rock or other acceptable material. Debris, frozen material, large clods, stones, organic matter or other unstable materials shall not be used for final backfill. When earth and rock is used it shall be placed and thoroughly consolidated with sufficient earth to completely fill all voids between the rocks. The Contractor shall so sort and stockpile the excavated material so that the proper material is available for backfill.

- b. The backfill material shall be compacted to a minimum of 80.0 percent of optimum density as determined by the Standard Proctor Test or shall be compacted to a density equivalent to the density of the immediate adjoining soil. The top six inches of backfill in street right-of-way shall be compacted to a minimum density of 95.0 percent of optimum density as determined by the Standard Proctor Test. Backfill material shall be placed and compacted only when its moisture content is within 2.0 percent of optimum moisture content as determined by Standard Proctor Test.
- c. The combination of the thickness of the layer, the method of compaction and the type of compaction equipment shall be at the discretion of the Contractor subject to obtaining the densities as specified above.
- d. The quality of the compactions shall be subject to compaction tests when deemed necessary by the Engineer.

It shall be the Contractor's responsibility to make necessary excavation in order to accommodate compaction tests at locations specified by the Engineer. The compaction tests will be performed at no cost to the Contractor. If the quality of the compaction does not meet the above requirements, the material will be removed and replaced to meet the above requirement, at the expense of the Contractor.
- e. Commercial sand backfill shall not be used.
- f. In areas marked "Garden" or "Flower Garden" on the Plans, the topsoil as excavated shall be stockpiled and replaced to original elevation, location and depth.
- g. Backfill material shall be carefully placed to avoid damage or displacement of sewer or structures.
- h. Backfill shall not be placed when material contains frost, is frozen, or a blanket of snow prevents proper compaction. Backfill shall not contain waste material, trees, organic material, rubbish, etc.

SS-7.2 Backfill of Pipe Trenches:

- a. The area below a plane six inches above the top of pipe bell shall be backfilled in accordance with the specifications for "Pipe Bedding".
- b. Backfill above a plane six inches above the top of pipe bell shall be made with suitable earth, earth and rock, or other acceptable material except that the area below a plane one foot above the pipe bell shall not contain any excavated rock. When earth and rock is used, the maximum dimension of the rock shall not exceed twelve inches.

SS-7.3 Backfill Around Structure:

- a. No backfill shall be placed over or around any structure until the concrete or mortar therein has attained a minimum strength 2000 psi and can sufficiently support the loads imposed by the backfill without damage.
- b. The Contractor shall use utmost care to avoid any wedging action between the side of the excavation and the structure that would cause any movement of the structure. Any damage caused by premature backfill or by the use of equipment on or near a structure will be the responsibility of the Contractor.
- c. Backfill shall be placed and compacted on all sides of the structure simultaneously, and operations shall be so conducted that the backfill is always at approximately the same elevation on all sides of the structure.
- d. No excavated rock larger than four (4) inches maximum dimension shall be placed within one (1) foot of the exterior surface of any structure.

SS-8.0 TUNNELING, BORING AND JACKING

SS-8.1 Scope: This section governs the furnishing of all labor, materials and equipment, and the performance of all operations necessary for the construction of tunnels complete with lining, bulkheads and sand fill at locations shown on the Plans or where constructed at the Contractor's option when approved to pass the utilities, streets or obstructions without open excavation.

SS-8.2

Tunnel Cross Section: Construct circular in cross section of size indicated. Alternate size and shape may be submitted for approval subject to the following:

- a. Best suited to proposed method of excavation and lining.
- b. Clear cross-sectional area not less than clear area of circular section indicated.
- c. Invert at grade consistent with adjoining open cut construction.

SS-8.3

Materials:

- a. **Steel Liner Plate:** Steel tunnel liner plates shall be Armco "Standard", Commercial Shearing and Stamping Company "Commercial", Republic "Truscon Paneled Out", or equal and shall be galvanized in accordance with ASTM A-123. The design and shape of the liner plates shall be such that assembly can take place entirely from within the tunnel liner. The outside diameter shall be four (4') feet and the minimum wall thickness shall be United States Standard Gauge 12 (0.1046 inches). Sufficient sections shall be provided with one and one-half (1 ½") inch or larger grouting holes, located near the centers, so that when the plates are installed there will be one line of holes on either side of the tunnel and one at the crown. The holes in each line shall not be more than nine (9') feet apart and, unless otherwise approved, shall be staggered. Bolts and nuts shall conform to ASTM A-153, A-307, A-325 and A-449 as applicable.
- b. **Steel Casings:** Steel casings for bored or jacked construction shall be steel pipe conforming to ASTM A-139 with minimum diameter as shown on the Plans.
 - 1. Minimum wall thickness shall be in accordance with the following table:

<u>Diameter of Casing</u>	<u>Nominal Wall Thickness</u>	
	<u>Under Railroads</u>	<u>All Other Uses</u>
24"	0.406"	0.281"
26"	0.438"	0.281"
28"	0.469"	0.312"
30"	0.469"	0.312"
32"	0.500"	0.312"
34"	0.500"	0.312"
36"	0.500"	0.344"

2. Steel shall be Grade B under railroads and Grade A on all other uses.
- c. Joints:
1. Steel liner plates shall have bolted joints in both longitudinal and circumferential planes. Stagger longitudinal joints in adjacent rings when assembling.
 2. Steel pipe shall have welded joints in accordance with AWWA C-206.

SS-8.4

Construction:

- a. **General:** Before starting work, complete details of the method of operation and liner materials to be used shall be submitted to the Engineer. The sewer, in the area to be tunneled, bored or jacked, shall be completed before the construction of adjacent portions of the same sewer lateral. The purpose of this requirement is to allow for slight discrepancies in alignment and grade which may occur in the tunneled, bored or jacked installation, so minor adjustments in the adjacent sewer can be made. The maximum allowable deviation in alignment and grade of sewer pipe shall be as shown on the Construction Plans.
- b. **Excavation:** Excavate by approved methods applicable to materials encountered. Boring operations shall be performed by experienced crews using a rotary-type boring machine designed especially for this purpose. Include dewatering and chemical soil stabilization or grouting if necessary due to existing field conditions. Conduct excavation in a manner to prevent disturbing the overlaying and adjacent material.
- c. **Lining:** Assemble liner plates immediately following the excavation. Advance casing continuously with excavation. When liner plates are being installed, care shall be taken to maintain alignment, grade and circular shape of the tunnel. All voids between liner and surrounding earth shall be filled with grout forced in under pressure. The grout shall consist of two parts of sand to one part of Portland Cement, mixed with sufficient water to maintain a freely pouring consistency. As the pumping through any hole is stopped, it shall be plugged to prevent the backflow of grout. After lining installation is complete it shall be cleaned of all debris and all leaks which allow flowing or seeping water into tunnel shall be stopped.

- d. **End Seals:** Construct end seals after sewer pipe has been permanently placed inside casing, tested and approved. Brick shall be in accordance with ASTM C-32, Grade SS or SM and mortar in accordance with ASTM C-270.
- e. **Casing spacers:** Carrier pipe shall be supported inside the casing pipe per the City Standard Drawings.

SS-9.0 ACCEPTANCE TESTS FOR SEWERS

SS-9.1 Scope: This section governs the furnishing of all labor, equipment, tools and materials, and the performance of any or all acceptance tests as required by the Plans, Special Provisions, and these specifications.

SS-9.2 Acceptance Tests for Gravity Sewers:

SS-9.2.1 Visual Inspection:

- 1. Contractor shall clean pipe of excess mortar, joint sealant and other dirt and debris prior to inspection.
- 2. Sewer will be inspected by flashing a light between manholes and/or by physical passage where space permits. Determine from illumination and/or physical inspection the presence of any misaligned, displaced or broken pipe and the presence of visible infiltration or other defects.
- 3. Correct defects as required prior to conducting leakage tests.

SS-9.2.2 Exfiltration Leakage Test to be performed on the full length of all lines prior to acceptance.

- 1. Contractor may perform leakage testing by exfiltration on sewer pipe larger than eighteen (18") inches I.D.
- 2. Furnish all labor, equipment, tools and materials required including bulkheads, water and all miscellaneous items required to perform the tests.
- 3. Test all sewer pipe over eighteen (18) inches I.D. after either the completed backfill or partial backfill sufficient to stabilize the position of the pipe in both alignment and grade is accomplished. Contractor may select sections of the project for testing at any time by notifying the Engineer 24 hours in advance.

4. Perform at depths of water as measured above centerline of pipe of not less than two (2) feet or more than ten (10) feet (consideration shall be given for water table above said centerline).
5. Maintain test as necessary to locate all leaks but not less than two hours.
6. Repeat as necessary after repair of leaks and defects until leakage, as measured, does not exceed 0.15 gallons per inch of internal diameter per hour per 100 feet of pipe length (100 gal/inch of I.D./day/mile).
7. Protect manholes and other structures by means of bulkheads to prevent bursting pressures from being applied inside the structure.
8. Dewater pipe upon completion of testing.

SS-9.2.3

Air Leakage Test to be performed on the full length of all lines prior to acceptance.

1. Contractor may perform air tests for all pipe sizes.
2. Furnish all facilities required including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator to avoid over- pressurization and all miscellaneous items required.
 - a. The pipe plug for introducing air to the sewer line shall be equipped with two taps. One tap will be used to introduce air into the line being tested, through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valves and fittings to accept a pressure test gauge indicating internal pressure in the sewer pipe. An additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.
 - b. The pressure test gauge shall meet the following minimum specifications:

Size (Diameter)	4 ½ inches
Pressure Range	0-15 P.S.I.
Figure Intervals	1 P.S.I. increments
Minor Subdivisions	0.05 P.S.I.

Pressure Tube	Bourdon tube or diaphragm ±0.25% of maximum scale reading
Dial	White coated aluminum with black lettering, 270 degree arc and mirror edge
Pipe Connection	Low male ½" N.P.T.

Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Engineer whenever air tests are performed.

3. Test each reach of sewer pipe between manholes after completion of the installation of pipe and appurtenances and the backfill of sewer trench.
4. Plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressure is allowed to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown on the table below, the pipe shall be presumed free of defects.

<u>Pipe Size</u>	<u>Required Time Per 100 LF</u>	<u>Maximum Required Time</u>
8"	70 sec.	227 sec.
10"	110 sec.	283 sec.
12"	158 sec.	340 sec.
15"	248 sec.	425 sec.
18"	356 sec.	510 sec.
21"	485 sec.	595 sec.
24"	634 sec.	680 sec.
27"	765 sec.	765 sec.
30"	851 sec.	851 sec.

33"

935 sec.

935 sec.

If air test fails to meet above requirements, repeat test as necessary after all leaks and defects have been repaired. Prior to acceptance all constructed sewer lines shall satisfactorily pass the low pressure air test.

5. In areas where ground water is known to exist, install a one-half inch diameter capped pipe nipple, approximately ten (10") inches long, through manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, ground water level shall be determined by removing pipe cap, blowing air through pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to pipe nipple. The hose shall be held vertically and a measurement of height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

SS-9.3

Acceptance Tests for Pressure Sewage Forcemains:

- a. Perform hydrostatic pressure and leakage tests. Conform to AWWA C-600 procedures as modified herein. Test shall apply to all pressure sewers. Perform after backfilling.
- b. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs. Select test segments such that adjustable seated valves are isolated for individual checking. Contractor shall furnish and install test plugs at no additional cost to the Owner, including all anchors, braces and other devices to withstand hydrostatic pressure on plugs.

Contractor shall be responsible for any damage to public or private property caused by failure of plugs. Limit full rate of line to available venting capacity.

- c. Pressure Test: Conduct at 1.5 times maximum operating pressure determined by following formula:

$$P_{pt} = 0.650 (OP-GE) \text{ in which}$$

P_{pt} = test pressure in psi at gauge elevation

OP = operating pressure in feet as indicated for highest elevation of the hydraulic gradient on each section of the line.

GE = elevation in feet at center line of gauge. Perform satisfactorily prior to determining leakage.

- d. Leakage Test: Conduct at maximum operating pressure determined by following formula:

$P_{It} = 0.433 (OP - GE)$ in which

P_{It} = test pressure in psi at gauge elevation

OP and GE = as in previous article.

1. All joints shall be watertight and free from leaks.

- e. Deflection Test:

Gravity pipeline flexible materials shall also be tested by pulling a mandrel. The test shall be conducted not less than thirty days after backfill has been properly installed. The maximum allowable deflection shall not exceed five (5) percent of the pipe's internal diameter. The test shall be performed without mechanical pulling devices.

Mandrel testing shall be performed on all flexible sewer main installed

If a section of line fails the test, the City will evaluate the sewer main and recommend a repair. The repair and additional testing shall be done by the Contractor at no additional cost to the City.

Any pipeline found not conforming to these requirements shall be replaced by the Contractor at no additional cost to the City, and shall then be retested. The City may, prior to the end of the warranty (guarantee) period, conduct another deflection test with City personnel. Any pipeline found not conforming to these requirements shall be replaced by the Contractor at no additional cost to the City, and the Contractor shall provide an additional warranty (guarantee) for not less than two (2) years for that portion of pipeline so replaced.

The City also reserves the right to conduct deflection tests on any sewer installation.

Mandrell shall be similar or equal to the "Wortco 9-Arm Mandrell" five (5) percent deflection for flexible or semi-rigid pipe as approved by the Engineer.

SS-9.4 Acceptance Test for Manholes

All manholes shall be vacuum tested by the contractor at his expense. Appropriate equipment and manpower will be furnished by the Contractor for this purpose.

When vacuum testing manholes, the following criteria are to be used:

1. This method is applicable to precast manholes only.
2. All lift holes shall be plugged with an approved non-shrink grout.
3. Manholes are to be tested after assembly and before backfilling. No standing water shall be allowed in the manhole excavation which may affect the accuracy of the test.
4. All pipes and other openings into the manhole shall be plugged and securely braced to prevent displacement of the plugs while the vacuum is drawn.
5. Installation and operation of vacuum equipment shall be in accordance with equipment specifications and instructions provided by the manufacturer.
6. The test head may be placed in the cone section of the manhole. The frame-cone joint will be visually inspected by the engineer.
7. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. The time for the vacuum to drop to 9 inches of mercury shall be recorded.
8. Acceptance for four (4) foot diameter manholes shall be defined as when the time to drop to 9 inches of mercury meets or exceeds the following:

<u>Manhole Depth</u>	<u>Diameter</u>	<u>Time to Drop 1" of HG</u>
10 ft. or less	4 ft.	60 seconds
10 ft. to 15 ft.	4 ft.	75 seconds
15 ft. to 20 ft.	4 ft.	90 seconds

9. For manholes five (5) foot in diameter, add an additional 15 seconds and for manholes six (6) foot in diameter, add an

additional 30 seconds to the time requirements for four (4) foot diameter manholes.

If the manhole fails to test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Re-testing shall proceed until a satisfactory test is obtained.

SS-10.0 SEEDING

SS-10.1 Scope: This section governs the furnishing of all labor, equipment, tools and materials, and the performance of all work for seeding, complete as specified in the Special Provisions and/or as shown on the Plans. All grassed areas disturbed which lie outside the Contractor's normal trenching operation areas shall be restored to a condition equal to or better than existing prior to construction. All provisions of Section TS-9 shall apply except as amended herein.

SS-10.2 The seeding mixture used to seed areas off street right-of-ways that are not maintained shall be as follows:

<u>Kind of Seed</u>	<u>Min. Pure Live Seed (%)</u>	<u>Rate Lbs Per Acre</u>
Alta Fescue or Kentucky 31 Fescue (Festuca Eliator Var. Arundines)	75	90
Rye Grass (Lolium Perenne 80 or L. Miltiflorum)	80	50
	Total	140#/acre

SS-10.3 Sowing shall be accomplished by use of an approved mechanical seeder or drill (hand spreader can be used in small area), making sure that successive seed strips overlap to provide uniform coverage. Seed should be drilled to a depth of one-half (1/2") inch.

SS-11.0 PAVEMENT REPLACEMENT

SS-11.1 Scope: This Section covers the furnishing of all labor, equipment, tools and materials, and the performance of all work for the replacement of pavement including sidewalks, driveways, and curbing, as specified on the Plans in the Special Provisions.

SS-11.2 Definitions: Pavement, as used herein, shall include Portland Cement Concrete (PCC), asphaltic concrete, asphaltic and lime or cement treated surface courses, and other similar types of construction, including

sidewalks, driveways, and curbing. Replacement, as used herein, shall mean reconstruction of the entire structural section of all pavements removed in excavated areas, including sidewalks, driveways, and curbing, and reconstruction or restoration of damaged pavement surfaces outside of excavation limits.

SS-11.3 General: In all areas of pavement removal replace pavement upon completion of sewer installation. All pavement not designated for removal that is damaged by the Contractor's operations shall be required, restored or replaced depending upon the degree of damage.

Prior to pavement replacement, all edges that were previously cut but have been subsequently damaged, shall be re-cut, and all adjacent undermined and heaved pavement shall be removed to the edge of the undisturbed trench.

SS-11.4 Pavement Replacement:

a. General: Removed pavement shall be replaced in conformance with the typical sections shown on the City Standard Drawings, Plans, and Technical Street Specifications, the requirements specified in the Special Provisions, and will generally be replaced in kind. Replacement shall include construction of all courses upon the subgrade for a complete pavement structural section. Restoration of damaged surfaces shall be as directed by the Engineer. Final pavement joints must be parallel or perpendicular to the street centerline.

b. Subgrade Compaction: Subgrade compaction shall conform to SS-7.0.

SS-12.0 MEASUREMENTS AND PAYMENTS

SS-12.1 Scope: This section covers the method of measurement and basis of payment for the furnishing of all labor, equipment, tools and materials and for the performance of all related work necessary to complete the sewer and appurtenances.

SS-12.2 Method of Measurement: The amount of completed and accepted work shall be measured or determined as follows:

1. Pipe Sewer:

a. Open Trenched: Measurement of various size, type and depth pipe sewer will be in linear feet, as listed on the Bid,

based on the true length of pipe computed from inside wall to inside wall of manholes along centerline of pipe sewer. Depth range as listed on the Bid and shown on the Plans is the average trench depth between adjacent manholes and will not be measured unless changed field conditions result in a change in the Plans by the Engineer.

- b. **Tunneled, Bored or Jacked:** Measurement will be made in linear feet for the applicable size of cast iron pipe sewer, tunneled, bored or jacked as listed in the Bid, based on the true length of pipe shown on the Plans, unless changed in the field by the Engineer.
2. **Manholes:** Measurement will be made for the applicable type, size and depth of manholes as listed in the Bid. The manhole depth shall be determined by measuring from top of casting to outlet pipe flowline.
3. **Encasement:** Standard concrete encasement will be measured in linear feet for the applicable size pipe, as listed in the Bid. Concrete collars will be measured as one (1') linear foot of concrete encasement based on true length of encasement along the centerline of pipe.
4. **Seeding:** Seeded areas will be measured horizontally in linear feet along centerline of sewer, regardless of width of disturbed area or type of seed used. Seeding will be measured only when centerline of sewer lies in grassed areas to be seeded, as shown on the Plans. When centerline of sewer lies in areas that are not grassed, such as street paving, driveways, parking areas, gardens, etc., no measurement will be made. Areas that are disturbed which lie outside the Contractor's normal trenching areas will not be measured for payment, but shall be restored to condition equal to or better than that existing prior to construction. When sewer ends in a grassed area, measurement will be made only to centerline of manhole.
5. **Rock:** Measurement of the quantity of excavated rock will be in cubic yards, as listed in the Bid, based on the true lengths and depths as measured in the field. Payline width shall be the outside diameter of the pipe plus twelve (12") inches. The minimum payline width shall be twenty-four (24") inches.

SS-12.3 Basis of Payment

Payment for the completed and accepted work shall be made as follows:

1. **Pipe Sewer:**
 - a. **Open Trenched:** Payment will be made at the contract unit price per linear foot for the applicable size, type and depth of pipe sewer, as listed in the Bid. Such payment and price shall constitute full compensation for all labor, materials, equipment and for the performance of all work necessary to complete the sewer, including excavation, sheeting and shoring, dewatering, preparation of bedding, installation of pipe sewer, backfilling, compaction, disposal of excess materials and replacement of pavement.
 - b. **Tunneled, Bored or Jacked:** Payment will be made at the contract unit price per linear foot for cast iron pipe sewer, tunneled, bored or jacked as listed in the Bid. Such payment and price shall constitute full compensation for all labor, material, equipment and for the performance of all work necessary to complete the sewer, including all excavation, sheeting and shoring, dewatering, installation of casing pipe, tunnel liner plate, grouting, installation of carrier pipe, sand fill, end seals, backfilling compaction and disposal of excess material, including all cost of jacking and pit(s).
2. **Manholes:** Payment will be made at the contract unit price per each for the applicable type, size and depth of manholes as listed in the Bid. Such payment and price shall constitute full compensation for all work necessary to complete the manholes, including excavation, sheeting and shoring, dewatering, concrete base, manhole steps, manhole ring and cover, waterproofing, reinforced concrete, backfilling, compaction and disposal of excess material.
3. **Encasement:** Payment shall be made at the contract unit price per linear foot of encasement, for the applicable size pipe as listed in the Bid. Such payment shall constitute full compensation for all labor, materials, equipment and for the performance of all work necessary to complete the item, including reinforced concrete collars.
4. **Seeding:** Payment will be made at the contract unit price per linear foot for seeding, regardless of type of seed, as listed in the Bid. Such payment shall constitute full compensation for all labor, materials, equipment and work necessary to complete the item, including grading, tilling, fertilizing, seed application, compaction and mulching.

5. **Rock:** Payment will be made at the contract unit price per cubic yard, as listed in the Bid. Such payment and price shall constitute full compensation for all labor, material, equipment, and all work necessary to complete the rock removal.

SS-13.0 SUBSIDIARY ITEMS

Section TS-30 shall apply.