

08010 Gravity Storm and Sanitary Sewer Construction

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08010-1 Scope

The General Conditions, Specific Conditions and Material Specifications form an integral part of these Specifications and shall be read in conjunction herewith.

This Section shall include Sewer Connections Construction not regulated by Section 08025 wherein sewer service connections are greater than 150mm in diameter.

The Contractor shall supply all material, labour, equipment, plant and tools necessary to construct the gravity storm and sanitary sewers within and/or under the jurisdiction of the City of Saskatoon as required under its Contracts.

1.1 Existing Infrastructure - Requirements and Fees

Certain fees for inspection, tapping mains, pavement and concrete repair, detouring services and public liability insurance shall be charged by the City to the Contractor on completion of the work.

The contractor shall obtain the conditions of work and fee rates by contacting the Water & Sewer Connections Desk at 975-2461 before estimating or commencing any particular project. The Water & Sewer Connections Desk will outline the requirements and fees so that the Contractor shall know in advance and the safety of the water and sewer system remains intact.

Before any work within the City Right-of-Way is performed, the Contractor shall have an approved permit "Use of Right-of-Way Permit". This permit shall be obtained by contacting the Transportation Right of Way Group at 975-2460. There may be restrictions on times and dates that portions of Right-of-Way may be available and this will be outlined in the Use of Right-of-Way permit.

08010-2 Existing Utilities and Structures

The location and elevation of existing underground utilities is compiled from records but is not guaranteed. Notwithstanding any other provision, the Contractor shall be responsible for determining at his expense the actual location and elevation of all sewer, water and gas lines, power, telephone or telecommunications conduits, or other such structures or utilities whether or not shown on the plans. The Contractor shall be responsible for notifying the respective utility at least 48 hours in advance of his

intention to carry out operations in the vicinity of the said utility and if required shall pay for any services supplied for locating these utilities.

When in the course of the work, existing utilities must, for reasonable cause, be temporarily disconnected, the Contractor shall be wholly responsible for notifying all persons affected, at least 48 hours in advance of the outage. The Contractor shall contact the utility owner who may disconnect the utility himself or supervise the Contractor during disconnection. In no case shall the Contractor operate any utility without the approval of the owner.

When a utility is exposed during construction, the Contractor shall immediately inform the owner of the utility, who may inspect the utility prior to backfilling.

Any accidental damage such as severing a cable, scraping the coating on an underground pipe or rupturing the pipe must be reported immediately through the appropriate emergency number.

Where existing utilities or other street improvements are found to be within the lines of the work the Engineer shall be notified. The Contractor shall then proceed as directed by the Engineer or the respective utility corporation.

All costs incurred for the disruption of service and for the repair of surface and/or underground utilities damaged by the Contractor's operation shall be the Contractor's responsibility.

Existing sidewalks and curbs, mains, service connections, catch basin leads and structures removed or damaged by the Contractor shall be repaired or replaced by the Contractor at his own expense.

Maintenance of existing utilities and structures which were disturbed or repaired by the Contractor, shall be the responsibility of the Contractor for the duration of the maintenance period.

08010-3 Excavation

3.1 General

Excavation shall be taken to mean the removal from the trench of all material of whatever kind encountered, for the construction therein of all sewers and manholes. All

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excavations shall be made to the lines and grades as shown on the plans or as established in the field by the Engineer.

3.2 Trenching

At no time will the length of the trench that is not backfilled to finished grade exceed 100 meters. The walls of the trench shall be sloped or shored up to prevent caving, in accordance with the requirements of the Occupational Health and Safety Regulations. All water encountered in the trench shall be pumped out before saturation of the pipe bedding material occurs. The discharge from the trench dewatering pumps shall be conducted away from the site of the work and into natural drainage channels, drains or storm sewers.

The trench shall be excavated so as to provide a uniform and continuous support for the pipe and fittings on solid undisturbed ground. Any over-excavation by the Contractor below the required grade shall be backfilled at his expense with compacted bedding material.

The earth taken from the trench shall be neatly deposited at the sides, in such manner as to obstruct the street or lane as little as possible. Where it is impracticable in the opinion of the Engineer to place the earth at the side of the trench, it shall be removed and deposited as designated by the Engineer. The Contractor shall repair all walls, crib work, culverts, drains, ditches and embankments which it may be necessary to remove or to pass through in laying the pipes.

The Contractor shall provide for all surface water courses and drainage systems interrupted during the progress of the work, and replace them in as good condition as originally encountered.

The Contractor shall remove all pavement from the surface of any area to be excavated prior to starting the excavation.

The edges of the areas to be removed shall be precut in straight lines for the full depth of the pavement. The Contractor shall then remove the pavement and transport it to the storage site designated by the Engineer.

3.3 Trench Width

The minimum trench width below the crown of the pipe shall be whichever is greater between the outside diameter of the pipe plus 450mm, or 1.25 multiplied by the outside diameter plus 300mm.

The maximum trench width below the crown of the pipe shall be as follows:

Table 1: Maximum Trench Width

Nominal Pipe Diameter	Maximum Trench Width Below Crown of Pipe
Less than 450mm	1050mm
450mm to 900mm	Pipe O.D. + 600mm
1050mm to 1350mm	Pipe O.D. + 750mm
1500mm and larger	Pipe O.D. + 900mm

3.4 Rock Excavation

Rock excavation is defined as boulders, pieces of concrete, or masonry equal to or exceeding 1cm in volume.

The Contractor shall use methods other than explosives such as drilling and wedging to split very large boulders prior to removing them from the trench.

Where the excavation is made in rock or in another material which cannot provide an even, uniform surface, all of the projections of such material shall be removed to provide a clear space around the pipe and fittings. The minimum dimension for this clear space shall be 150mm for pipe having an outside diameter less than or equal to 600mm and 225mm for pipe having an outside diameter greater than 600 mm.

The subgrade shall then be made by backfilling with bedding material compacted in 150mm layers to provide a uniform and continuous support for the pipe.

3.5 Unstable Subgrade

Where, in the opinion of the Engineer, the bottom of the trench at the subgrade below the pipe bedding is found to be unstable or to contain organic or other deleterious material which would not provide a sound foundation for the pipe, the Contractor shall remove such material to the width and depth ordered by the Engineer and shall replace it with crushed rock, compacted in 150mm layers. Prior to placing the crushed rock,

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geotextile fabric shall be installed flat on the trench bottom. The fabric shall extend up the trench walls to accommodate a minimum seam overlap of 900mm or equivalent to the trench width. The top surface of the crushed rock shall be covered with geotextile fabric before any pipe bedding aggregate is placed.

Where, in the opinion of the Engineer, additional support is required for the pipe, the Contractor shall supply all materials and shall construct such additional support in accordance with the plans and specifications which will be provided to him by the Engineer.

08010-4 Temporary Protective Structures

The Contractor shall protect excavations, trenches, shafts and tunnels from cave-ins, collapse, sliding or rolling materials by cutting back the walls and/or supplying and installing Temporary Protective Structures as required by the Occupational Health and Safety Regulations and as may be necessary to protect adjacent property and the work.

The Contractor shall install Temporary Protective Structures to prevent movement in the sides of the excavations. All material required, as well as the labour required for the installation, shall be furnished by the Contractor as part of this Contract.

The Contractor shall ensure that, where required by the Occupational Health and Safety Regulations, a professional engineer certifies that the Temporary Protective Structure, if constructed as drawn, and installed and used as instructed, will provide adequate protection to any worker constructing, installing or using the Temporary Protective Structure. The Contractor shall, prior to commencing construction, provide the Engineer with a copy of this certification for each Temporary Protective Structure which will be used on the project.

The right of the Engineer to order sheeting, bracing, underpinning or any other form of brace or support shall not be construed as creating any obligation on his part to issue such orders and his failure to exercise his right to do so shall not relieve the Contractor from his responsibility for damages to persons or property arising from or upon the work of construction occasioned by negligence or otherwise growing out of a failure on the part of the Contractor to leave in place in the trench sufficient sheeting and bracing to prevent any caving or moving of the ground adjacent to the sides of the trench, or for failure to construct and maintain proper support of all kinds whatsoever in the first instance.

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Sheeting and bracing ordered left in place must be cut off and removed for a depth of 900mm below the established street grade or the existing surface of the street, whichever is lower.

08010-5 Preparation of Trench Bottom

The Contractor shall remove any water which has accumulated in the excavation by pumping before any bedding is placed. The previously installed pipe shall not be used to drain the trench. Loose material shall be removed from the surface and the subgrade shall be thoroughly compacted.

08010-6 Pipe Bedding**6.1 General**

The type of bedding to be used with each size and class of pipe shall be as shown on the Tender Form and in the Specific Conditions. The following various classes of bedding are detailed on the current City of Saskatoon Standard Drawing as posted on the City's Internet web site.

6.2 Class A Bedding

The pipe shall be bedded on a continuous cradle constructed of 30MPa concrete shaped to fit the lowest part of the pipe exterior. The concrete shall be made using Type HS/HSb sulphate resistant cement. The required minimum concrete cradle thickness under the pipe shall be as outlined on the current City of Saskatoon Standard Drawing as posted on the City's Internet web site for various pipe diameters and shall extend up the sides of the pipe to a height equal to 1/4 of the outside diameter of the pipe. The concrete cradle shall extend over the whole width of the trench and shall be constructed monolithically without horizontal construction joints.

6.3 Class B Bedding

The pipe shall be bedded on a layer of approved pipe bedding aggregate as defined in Section 03001-3.2.7 shaped to fit the lowest part of the pipe exterior. The required minimum depth of the granular material under the pipe shall be as outlined on the current City of Saskatoon Standard Drawing as posted on the City's Internet web site for various pipe diameters and shall extend up the sides of the pipe to a height equal to 1/2 of the outside diameter of the pipe. Care shall be taken to completely fill all voids under

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the pipe. The bedding material shall be placed in 150mm layers and shall be compacted to 98% of its Standard Proctor Density using mechanical compaction equipment.

08010-7 Pipe Laying and Jointing

7.1 General

The pipe shall be protected against impact shocks and free fall during handling and shall be kept clean at all times.

Each pipe shall be carefully inspected prior to being lowered into the trench and those not meeting specifications shall be rejected and shall be removed from the site of the work. Pipe laying shall commence at the lowest point of the sewer. The individual pipe lengths shall be laid in an uphill direction with spigots pointing downgrade and bell ends in the upgrade direction. The Contractor shall excavate the trench deeper at the location of each joint to facilitate making the joint and so that the pipe will not rest on the bell when it is installed. Each pipe shall be installed so that the bedding material will support it evenly throughout its entire length. The interior of the pipe and the bell must be cleared of all foreign material before the joint is made. The sections of pipe shall be fitted together to form a smooth and uniform invert.

The Contractor shall supply a watertight cap or plug which shall be installed on the end of the pipe while excavation is in progress and when the Contractor leaves the site of the work.

7.2 Alignment and Grade

Gravity sewers shall be installed according to the lines and grades shown on the plans or as staked in the field by the Engineer. The Contractor shall transfer line and grade to the sewer by means of an approved batter board and boning rod system, laser beam system, or other system approved by the Engineer.

Variance from grade shall not exceed 0.03mm per mm of pipe diameter or 10mm whichever is greater. Provided in all cases that such variation does not result in a reverse sloping invert.

Variance from alignment shall not exceed 2 times the variance allowed for grade.

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7.3 Polyvinyl Chloride (PVC) Pipe

Polyvinyl Chloride (PVC) shall be installed as per ASTM D2321 unless specified otherwise.

PVC pipe shall be jointed as follows. The bell, spigot and rubber gasket shall be cleaned with a clean cloth, removing all traces of dirt, grit or plastic cuttings. A thin film (equivalent to a brushed coating) of a lubricant manufactured for this purpose shall be applied uniformly to the bell and spigot areas as indicated by the pipe manufacturer's published recommendations. With the assistance of a lever pressing on a wooden cushion block which has been placed against the bell end of the pipe, a uniform force shall be applied until the pipe has been inserted to the reference mark.

The Contractor shall use a fine tooth hand saw or a power cut-off saw to cut the pipe where this is required. The ends shall be cut square and shall be bevelled at 15° through 1/2 of the wall thickness using a grinding disc or a flat file. The jointing reference mark shall be re-established using a factory marked pipe of the same size as a guide.

7.4 Concrete Pipe

The sealing surfaces of the pipe shall be carefully checked to ensure that they are smooth, concentric and free from any imperfections which might impair the sealing efficiency of the rubber gasket. Both the tongue and the groove shall be cleaned and the gasket shall be installed on the tongue in accordance with the manufacturer's instructions.

All sliding surfaces shall be well lubricated and the pipes immediately coupled. The interior vertical mating surfaces of the joint are to be uniformly tight with a maximum separation not greater than that recommended by the pipe manufacturer. The proper equipment shall be used to pull the pipes together to ensure that the joints are properly engaged.

Where the alignment of the pipe produces a radius curve which would cause the joints to "open up" beyond the manufacturer's recommended allowable limit, the Contractor shall install radius pipe to accommodate the curve in the alignment.

7.5 Polyethylene Pipe

Polyethylene pipe which is being used for sewer construction shall be joined by butt fusing the ends of the pipes. The Contractor shall use the specially designed joining machines complete with alignment jigs, trimmers and heating plate which can be obtained from the pipe manufacturer. The Contractor shall provide personnel who have been trained to perform this procedure and shall ensure that the joints are made in accordance with the manufacturer's specifications.

08010-8 Manholes**8.1 General**

The Contractor shall construct manholes on gravity sewers at the locations and grades shown on the plans or as staked in the field by the Engineer.

The Contractor shall supply all materials and construct manholes on the sewer mains in accordance with the City of Saskatoon Standard Drawings as posted on the City's Internet web site.

1050mm manholes are not permitted for new construction or reconstruction.

Concrete shall conform to Section 08000-9 "Concrete".

Unshrinkable fill shall conform to Section 08000-8 "Unshrinkable Fill".

Grout shall conform to Section 08002-5.4 "Grouted-In Connector".

All sanitary sewer manhole bases shall have a half section of pipe cast in the base with 35MPa Type HS sulphate resistant concrete benched into it. The pipe channeling shall be seamless for straight through and dead end manhole bases.

All sanitary and storm pipe to manhole connections shall incorporate a seal, resulting in a watertight pipe to manhole connection.

Pipe to manhole and concrete structure connections shall conform to Section 08002-5 "Pipe to Manhole and Concrete Structure Connectors".

The Contractor shall install stub pipes for future connections at the alignment and grades shown on the plans or as established in the field by the Engineer. The stubs shall be sealed with suitable plugs which will not admit earth or water into the manhole.

The Contractor shall construct a standard City of Saskatoon exterior drop structure at the manhole on any sanitary sewer line where the incoming sewer crown is 750mm or more above the lowest crown of outlet pipe in the manhole.

8.2 Cast-In-Place Manhole Base

Standard 1200mm manholes for sewers 675mm to 900mm in diameter shall have the base constructed using substantial forms. The practice of pouring an unconfined mass of concrete for the base is not acceptable. The Contractor shall not cast the manhole barrel into the manhole base. The opening shall be formed as shown on the standard drawings and the manhole barrel shall be installed into the recess after the forms have been removed.

All manholes constructed on 200mm to 600mm diameter sewers shall have a minimum 150mm thick, measured from the invert, 35MPa Type HS sulphate resistant concrete base, and a single mat of 10M reinforcement at 200mm on centre each way, on manholes over 4.5 metres deep and manholes with an external drop structure. Substantial forms shall confine the concrete.

Saw cut openings (dog houses), will be permitted at the manhole base when tying into the required base half pipe.

8.3 Precast Manhole Base

All precast manhole bases shall be supplied with extra wide bases. For standard 1200mm manholes with a wall thickness of 127mm, the extra wide base shall have an outside diameter of 1829mm.

8.4 Foundation

8.4.1 Stable Subgrade

The Contractor shall excavate in-situ material to the underside of the manhole base elevation. Surface is to be stable, undisturbed material.

If over excavation occurs then the minimum depth shall be equivalent to the thickness of the manhole base slab. Over excavation depth shall not exceed 600mm.

The Contractor shall backfill the over excavation with Pipe Bedding Aggregate in 150mm lifts compacted to 98% Standard Proctor Density.

An alternative to backfilling the over excavation with pipe bedding aggregate is to use crushed rock, geotextile fabric and pipe bedding aggregate as contained in Specification 8.4.2 Unstable Subgrade.

8.4.2 Unstable Subgrade

The Contractor shall over excavate to a minimum depth of 200mm below the underside of the manhole base elevation.

The Contractor shall backfill the over excavation with crushed rock, compacted in 150mm lifts. Prior to placing the crushed rock, geotextile fabric shall be installed flat on the trench bottom. The fabric shall extend up the trench walls to accommodate a minimum seam overlap of 900mm or equivalent to the trench width. The top surface of the crushed rock shall be covered with geotextile fabric before any pipe bedding aggregate is placed.

The depth of pipe bedding aggregate below the manhole base shall be 100mm. The pipe bedding aggregate shall be compacted to 98% Standard Proctor Density.

8.5 Pipe Supports

8.5.1 Concrete

Concrete pipe supports shall conform to City of Saskatoon Standard Drawing 102-0011-011.

Where specified or approved by the Project Engineer, the Contractor shall use Type HS sulphate resistant concrete to backfill the space under a new concrete pipe to undisturbed soil where it connects to a manhole, including PVC external drop structures.

Concrete fill shall only be placed against undisturbed ground or against substantial forms, which the Contractor shall construct, to contain the concrete while it is being

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placed. These forms shall be removed after the concrete has set and before the Contractor may backfill the remainder of the excavation. The Contractor may not use non-compacted earth backfill as a form to contain the concrete.

8.5.2 Non Shrink / Unshrinkable Fill

The Contractor shall use unshrinkable fill to backfill the space under a new pipe; including service connection pipe, where it connects to a manhole, the space under a new pipe crossing over the excavation adjacent to a manhole, the space between mains of a different elevation which cross in a trench and any portion of an excavation which cannot be mechanically compacted.

Unshrinkable fill shall only be placed against undisturbed ground or against substantial forms, which the Contractor shall construct, to contain the unshrinkable fill while it is being placed. These forms shall be removed after the unshrinkable fill has set and before the Contractor may backfill the remainder of the excavation. The Contractor may not use earth backfill as a form to contain the unshrinkable fill.

8.6 Build Up

Manhole bases shall be channelized and benched prior to build up.

If the Contractor chooses to channelize and bench manholes after build up, they shall supply a camera for inspection. If camera inspection is done, a Panoramio SI 3D Optical Manhole Scanner will be used with video footage submitted to the Engineer.

The manhole riser section barrels shall use Tylox Super Seal Gaskets on all joints.

Cement mortar shall not be used on the rubber gasket joints of manholes constructed with 1200mm diameter precast sections.

The manhole base shall be level and the barrels shall be plumb.

The exposed flat concrete shelf from a precast transition slab top to the manhole barrel riser shall be benched with non-shrink, Type HS sulphate resistant grout, to prevent debris from collecting.

The manhole rungs shall be installed such that they are aligned, uniformly spaced and do not interfere with the incoming piping.

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Manhole safety platforms shall conform to City of Saskatoon Standard Drawing 102-0011-001 available on the City's web site.

Manholes shall be constructed to final grade by installing rubber adjustment riser rings, one or more concrete grade rings and tapered/or non-tapered adjustment riser rings between the tapered precast manhole section and the cast iron frame. The minimum and maximum depth of grade rings permitted shall be 50mm and 300mm respectively or as directed by the Engineer.

The joints between the top of the tapered precast manhole section, rubber adjustment riser rings, concrete grade rings, tapered/non-tapered rubber adjustment riser rings and the cast iron frame and the joints between themselves shall be bonded using a waterproof elastomeric polyurethane sealant. The sealant shall be applied in a continuous bead around the above noted components approximately 25mm from the inner and outer edges. The sealant must be sufficiently placed between all rings (rubber and concrete) and frames so that when the components are placed together the total areas touching are covered and sealant is squeezed out around the entire inner and outer circumference. A finished bead of sealant shall be placed on the inside and finished smooth. The supply and application of the sealant shall be the responsibility of the Contractor.

08010-9 Backfill

9.1 Initial Backfill in Pipe Zone

The Contractor shall hand place select excavated material which is free from lumps and stones in 150mm lifts above the granular bedding on both sides of the pipe and to a point 300mm above the crown of the pipe over the full width of the trench. The Contractor shall compact each lift to 98% of its Standard Proctor Density.

Placement of haunching materials shall be carried out by methods that will not disturb or damage the pipe.

The haunching material shall be worked in and tamped in the area between the bedding and the underside of the pipe before placement and compaction of the remainder of the material in the embedment zone.

Compaction equipment and methods used in the haunch zone shall be compatible with the materials used, the location in the trench, and the in-place densities required.

9.2 Backfill above Pipe Zone

9.2.1 Class I Backfill

Approved granular material with a maximum aggregate size of 75mm, shall be placed in 300mm lifts over the whole width of the trench. Each lift shall be compacted to 98% of Standard Proctor Density, using mechanical compaction equipment.

9.2.2 Class II Backfill

Approved excavated material shall be placed in 300mm lifts over the whole width of the trench. Each lift shall be compacted to 98% of Standard Proctor Density, using mechanical compaction equipment.

This backfill may contain course materials but shall be free from brush, frozen or other objectionable material that would prevent proper consolidation or that might cause subsequent settlement.

Rocks or stones not exceeding 10kg in weight may be placed in this portion of the backfill but must be placed by hand.

The Contractor shall be responsible for controlling the moisture content of the backfill material so that the moisture content shall be within 2% of the optimum moisture content as determined by the Standard Proctor Compaction Test. The Contractor shall add water to the material if the moisture content is too low or if the moisture content is too high, the Contractor shall move the material to an approved stockpile area, dry the material and then move the material back to the site of the work. Any test results over 103%, using any testing method, will be considered suspect and may be discarded at the discretion of the City.

9.2.3 Class III Backfill

Class III backfill shall consist of approved excavated material free from brush and rocks or stones over 10 kilograms and other objectionable material. Backfill material shall be pushed down a ramp or slope of existing backfill and not directly onto the newly bedded pipe.

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The backfill material shall be placed in 750mm lifts over the whole width of the trench. Each lift shall be compacted to a density which is equal to the density of the adjacent soil.

9.2.4 Backfill around Manholes

The Contractor shall carefully select, place and compact backfill material in 150mm lifts for a distance of 600mm around each manhole. The contractor shall compact each lift to a minimum of 98% of the Standard Proctor Density.

9.2.5 Trench, Pipe and Backfill remediation after rain events

Where in the opinion of the City Engineer, any portion of the backfill material which is deemed unstable, the city will request density and proof-roll tests to assess the previously placed and compacted backfill.

Upon testing, if the backfill material is deemed unstable, the Contractor shall submit a remediation plan to remove/re-compact and re-test the backfill material for densities before placing of succeeding layers. The proper moisture content shall be within $\pm 2\%$ of the optimum moisture content as determined by the Standard Proctor Compaction Test.

The conditioned backfill material shall be placed and compacted as per Section 08010-9 Backfill. Where, in the opinion of the City Engineer, any portion of the pipe bedding in the pipe zone are deemed unstable and compromised after a rain event, the City will request a test to assess the placed pipe bedding. Upon testing, if the materials are deemed unstable, the Contractor shall submit a remediation plan to remove and reinstall the pipe and bedding material as per Section 08010 – 6 Pipe Bedding, Section 08010 -7 Pipe Laying and Jointing, Section Unstable Subgrade 08010-3.5 and Section Trenching 08010-3.2.

The Contractor shall confirm that the pipe material complies with Section 08002 Construction Materials – Sewage Mains. In case of unstable trench walls, trench sidewalls moisture shall be checked and not backfilled against until they are less than 2% over optimum moisture.

9.3 Street Surfaces**9.3.1 General**

The Contractor shall use a rubber tired motor grader to spread surface granular materials during compaction and to level earth streets after the backfilling has been completed.

The Contractor shall be responsible for filling trench settlements and repairing street surfaces which settle along the lines of his work during the maintenance period.

9.3.2 Paved Streets

Where excavation has been carried out on a paved street or on a street which has been based and is ready for pavement, the Contractor shall backfill the excavation up to 300mm below the level of the original street surface. The Contractor shall then place 300mm of base gravel to the gradation as specified in Section 08000-7.2 flush with the original street surface and shall compact it to 100% of Standard Proctor Density. Prices tendered for laying pipe, shall include the supply and placing of this gravel unless specified otherwise.

9.3.3 Gravel Streets

Where the excavation has been carried out on a gravel street, the Contractor shall backfill the excavation up to 100mm below the level of the original street surface.

The Contractor shall then place 100mm of base gravel to the gradation as specified in Section 08000-7.2 flush with the original street surface and shall compact it to 100% of Standard Proctor Density. Prices tendered for laying pipe, shall include the supply and placing of this gravel unless specified otherwise.

9.3.4 Earth Streets

Where excavation has been carried out on a graded earth street, the Contractor shall backfill the excavation up to the level of the original street surface.

Where the surface of the street has not previously been cut to grade, the Contractor shall spread and level any surplus excavated material over the top of the excavation.

9.3.5 Surplus Excavated Material

Where excavation has been carried out on a paved street, gravelled street or graded earth street all of the excavated material may not be required for backfilling. The Contractor shall load and haul this surplus excavated material to the nearest earth dumping site or to the location as specified in the Specific Conditions. The costs of disposing of this material shall be included in the Contractor's unit prices for constructing sewers.

08010-10 Testing

10.1 General

The Contractor shall supply all of the labour and equipment necessary to perform **infiltration and exfiltration tests and CCTV inspection**. The costs of testing **and inspection** shall be included in the Contractor's unit prices for constructing sewers.

10.2 Infiltration Testing

The pipe at the highest point on the infiltration test section shall be sealed with a water tight plug. The amount of water infiltrating into the test section shall be measured at the low end of the test section by means of an approved weir or meter.

The duration of the test shall not be less than 4 hours and the length of the test section will be as determined by the Engineer.

10.3 Exfiltration Testing

The pipe section to be tested shall be sealed at its lower extremity with a water tight plug and filled with water so that a hydrostatic head of 600mm is formed above the crown of the pipe at the upper end of the test section.

In no case shall the pressure head on any part of the test section be in excess of 3m of water.

The 600mm head of water shall be maintained by the addition of water for 1 hour prior to commencing the test to allow for normal absorption.

The length of the test period shall not be less than 6 hours. The Contractor shall continue to add water as required throughout the test period in order to maintain the 600mm head of water on the test section. The water added during this time shall be considered to be equal to that lost due to exfiltration.

10.4 Allowable Leakage

The maximum allowable leakage of gravity sewers and appurtenances subjected to exfiltration or infiltration testing shall not exceed 1.85 litres per 24 hours per millimetre of diameter per 100m of sewer pipe.

The Contractor shall, where the actual leakage on a section of sewer exceeded the allowable, repair and/or replace the section and then retest the section until the actual leakage no longer exceeds the allowable.

10.5 CCTV Inspection

All gravity storm and sanitary sewer mains constructed shall be cleaned and camera inspected in accordance with NASSCO PACP standards as described in Section 08125 – CCTV CAMERA AND SEWER MAIN INSPECTION, contained in the current City of Saskatoon Standard Construction Specifications and Drawings, unless otherwise specified herein.

Prior to commencing testing, the contractor must submit a testing plan to the Engineer for acceptance 14 calendar days prior to the work. At a minimum, the plan must consist of how the work will be successfully completed and shall include: summary of equipment being used, confined space entry requirements, acknowledgment the pipes and manholes have been cleaned and are ready for post installation inspection.

The unit price for CCTV Camera Inspection will be paid per linear meter of pipe cleaned, inspected and recorded regardless of pipe size, class and depth. No payment shall be made for the inspected sections of pipe not accepted by the Engineer. Only after pipe deficiencies have been repaired and re-inspected, will payment be made for CCTV Camera Inspection. Measurement shall be taken from the length recorded on the submitted inspection report accepted by the Engineer.

Payment shall include the supply of materials, equipment, labour, supervision and all other items required to perform the inspection work as specified.

08010-11 Clean Up

The Contractor shall clean up the site as the work progresses.

The Contractor shall remove all of his equipment, plant, tools and surplus material from the site of the finished work and shall repair and restore all drainage facilities which have been blocked or damaged as a result of the Contractor's operations.

End of Specification 08010