

**SPECIFICATIONS**  
**FOR**  
**SANITARY SEWER AND STORM SEWER**

**CITY OF EDINA, MINNESOTA**

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**Revised January 2016**

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**SPECIFICATIONS**  
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**Revised January 2016**

1.0 **GENERAL**

The General Conditions and the Special Provisions and Conditions as embodied in these Contract Documents shall be applied to all work and materials to be furnished and installed under these specifications.

2.0 **LOCATION**

The sewer and appurtenances to be constructed and installed under this contract are located in the City of Edina, Hennepin County, Minnesota, as shown on the plans and drawings.

3.0 **SCOPE OF WORK**

The work to be done under this contract shall include the furnishing of all material, labor, tools, and equipment to construct, complete and in place, the sewer and all appurtenances as shown on the drawings and as specified herein and in accordance with all pertinent requirements of the Minnesota Pollution Control Agency and Minnesota Department of Health.

This Contractor shall perform the excavating of all kinds of materials encountered, furnish or compact foundations where required, furnish and install all timbering, sheeting and bracing necessary or proper to safely support all work, remove all water, protect, repair, relocate, maintain and restore all sub surfaces, surface and overhead structures directly or indirectly disturbed, injured or affected by his/her operations, backfilling and furnish all other appurtenant items and services necessary or specified.

4.0 **METHOD OF PROCEDURE**

The Contractor shall perform his/her work in such a manner as to cause the least interference and delay to such other work as may be in progress at the time by other Contractors. The Contractor shall notify the Engineer in writing of his/her intentions to commence work at least five (5) days prior to his/her moving onto the site.

Prior to the start of any work, the Contractor shall submit in writing to the Engineer for approval, a schedule of procedure and, once approved, the Contractor shall not deviate from it without written permission from the Engineer. The schedule of procedure shall essentially indicate the number of crews to be employed, locations of work for each crew, time schedule and sequence of moves and other pertinent information as required by the Engineer.

5.0 MATERIALS AND TESTING

The materials required for this work shall be new material conforming to the requirements for class, kind, type, grade, size and other details indicated in the Contract for materials as specified below. The Contractor shall submit in writing a list of materials to be furnished showing the manufacturer and designation of all items, said list to be approved by the Engineer prior to installation. If any options are provided for, as to type, grade, or design of the material, the choice shall be limited as may be stipulated in the Plans, Specifications, or Special Provisions.

All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Plans. Otherwise, the Owner may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

5.1 Reinforced Concrete Pipe

Reinforced concrete pipe (“RCP”) shall conform to the requirements of MnDOT Standard Specification for Reinforced Concrete Pipe (3236) with R-4 joints and sealed in accordance with MnDOT Standard Plate 3006.

Pipe Cover	Pipe Class
0-3'	CL-V
3'-4'	CL-IV
4'-5'	CL-III
5'-10'	CL-II
10-16'	CL-III
16'-26'	CL-IV
26' & Over	CL-V or Special as Required

Table 1. RCP Pipe Strength-Depth Classification

NOTE: All RCP 18” diameter or less shall be CL-V. For RCP sizes greater than 18” diameter, the first 3 classifications in the Table 1 shall apply to RCP installed in the roadway. However, if not under heavy loads & installed out of the roadway limits, CL-II pipe may be used for 0-10' depth of cover. All RCP shall be a minimum of eight feet (8') in length. All RCP

shall be clearly marked with markings showing in the proper position when laid.

Pipe strength classifications may only be used with the cover and depth brackets described in Table 1, listed on the Proposal Form and shown on the plans if the trench width is in strict accordance with Article No. 7 "Excavation and Preparation of Trench" of these Specifications.

## 5.2 Reinforced Concrete Bends

Both long and short radius reinforced concrete bends shall conform to the requirements of the Standard Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, ASTM Designation C76 for Classes III, IV and V.

Class III bends shall be used wherever there is sixteen feet (16') or less of cover over the top of pipe; Class IV bends shall be used wherever there is more than sixteen feet (16') but less than twenty-six feet (26') of cover over the top of pipe; and Class V bends shall be used wherever there is more than twenty-six feet (26') of cover over the top of pipe.

Pipe strength classifications may only be used with the cover and depth brackets described above, listed on the Proposal Form and shown on the plans if the trench width is in strict accordance with Article No. 7. "Excavation and Preparation of Trench" of these Specifications.

## 5.3 Corrugated Polyethylene Pipe Sewer

This work shall consist of furnishing and installing dual-wall, smooth interior, corrugated polyethylene pipe and fittings in accordance with the Plans, MnDOT Standard Specifications 2503, AASHTO M294, Section 12 of the AASHTO LRFD Bridge Design Specifications, and the following:

Corrugated polyethylene (CP) shall be allowed for use only for storm sewer outside of the paved roadway limits as designated in the Plans.

(CP) pipe and fittings shall be manufactured from high-density polyethylene (HDPE) virgin compounds. Clean reworked HDPE materials from the manufacturer's own production may be used by the manufacturer of HDPE pipe, provided that the pipe and fittings produced meet all the requirements of these Special Provisions, AASHTO M294 and Section 12 of the AASHTO LRFD Bridge Design Specifications.

Couplings and Connections shall be made with bell and spigot joints. Bell and spigot joints shall use a gasket if necessary to make the joint soil-tight.

When a watertight joint is specified in the Plans, it shall be required that the joint meet the requirements of ASTM D3212 except as modified. The internal pressure test shall be performed at 68 kPa (10 psi) (minimum) with the pipe in straight alignment. The vacuum test is not required. The Engineer shall be provided a laboratory certification that the pipe coupler for each size of pipe meets or exceeds these requirements. The Engineer shall also be furnished shop drawings of each pipe coupler.

Each pipe shall be identified with the manufacturer's name, trade name, or trademark and code from plant location, machine and date of manufacture; nominal pipe size in inches; Ring Stiffness Constant Classification; and ASTM F894.

#### 5.4 Polyvinyl Chloride Pipe and Fittings (PVC)

Smooth walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the size, standard dimension ratio (SDR), and strength requirements indicated on the Plans, Specifications, and Special Provisions. The grade used shall be resistant to aggressive soils or corrosive substances in accordance with the requirements of ASTM D-543.

Unless otherwise specified, all pipe and fittings shall be SDR 35 or approved equal, and connections shall be push-on with elastomeric gasketed joints which are bonded to the inner wall of the gasket recess of the bell socket.

Corrugated polyvinyl chloride pipe and fittings with smooth interior shall conform with the requirements of ASTM F-949 for the size and wall thickness indicated on the Plans, Specifications, and Special Provisions.

Unless otherwise specified, all pipe and fittings shall be push-on with snug fit elastomeric joints meeting tightness requirements of ASTM 3212.

#### 5.5 High Density Extra-High Molecular Weight Polyethylene (HDPE) Pipe

- a) Thermal Butt-Fusion Method of joining.
- b) NSF: Standard No. 14.
- c) PPI Designation: PE 3408.
- d) Cell Classifications: ASTM D3350-PE 345444C.
- e) Material Description: ASTM D3350-Type III, Grade PE 34.
- f) Color: Black

- g) Continuously mark pipe with the following information.
  - (1) Size and dimensions
  - (2) Name of manufacturer
  - (3) Cell class
  - (4) ASTM basis
  - (5) Pipe test category
  - (6) Plant identification
  - (7) Production data
  - (8) Operator number
  - (9) Resin supplier code
- h) Manufacturer
  - (1) All HDPE pipe shall be as manufactured by Rinker Materials “CSR PolyPipe”, Gainsville, Texas; Phillips “Driscopipe”, Richardson, Texas; Chevron “Plexco”, Bensenville, Illinois, or approved equal.

#### 5.6 Deflection Test

Deflection tests shall be performed on all plastic gravity sewer pipes. The test shall be conducted after the sewer trench has been backfilled to the desired finished grade and has been in place for 30 days.

PVC Pipe deflection testing shall be performed by the Contractor using a nine-point mandrel approved by the Engineer. The deflection test shall be performed by pulling a rigid nine-pointed mandrel through the pipe without the aid of mechanical pulling devices. The line used to pull the mandrel shall be rated no more than 150-pound tensile strength. The mandrel shall have a minimum diameter equal to 95% of the actual inside diameter of the pipe. The maximum allowable deflection shall not exceed five percent of the pipe's internal diameter. The time of the test, method of testing, and the equipment to be used for the test shall be subject to the approval of the Engineer. Pipe through which the mandrel does not pass shall be considered unacceptable.

Corrugated Polyethylene Pipe Deflection testing shall be performed by the Contractor using a nine-point mandrel approved by the Engineer. The diameter of the mandrel shall be as shown on Table 2. The mandrel must be pulled through the pipe by non-mechanical means. Pipe through which the mandrel does not pass shall be considered unacceptable.

PIPE DIAMETER		MANDREL DIAMETER	
mm	(Inches)	mm	(Inches)
300	(12)	285	(11.40)
375	(15)	360	(14.25)
450	(18)	430	(17.10)
600	(24)	575	(22.80)
750	(30)	720	(28.50)
900	(36)	865	(34.20)

Table 2. Corrugate Polyethylene Pipe Sewer Mandrel Diameter Criteria

All testing shall be performed by the Contractor at his/her expense without any direct compensation being made therefore, and he/she shall furnish all necessary equipment and materials required.

#### 5.7 Test Failure and Remedy

In the event of test failure on any test section, the section shall be replaced, with all repair work subject to approval of the Engineer. New pipe or deformed pipe that is not damaged shall be re-laid. The replaced section shall be retested for leakage and deflection in conformance with the specifications contained herein. The re-laid pipe shall be retested for deflection after no less than five days. All repairs, replacement, and retesting shall be at the Contractor's expense.

#### 5.8 Sanitary Sewer Leakage Testing

All sanitary sewer lines, including service connections, shall be watertight and shall be tested for leakage upon completion and before connections are made to the service by others. Each test section of the sewer shall be subjected to exfiltration testing, either by hydrostatic or air test method as described below. The requirements set forth for maximum leakage shall be met as a condition for acceptance of the sewer section represented by the test.

If the ground water level is greater than three feet above the invert elevation of the upper manhole and the Engineer so approves, infiltration testing may be allowed in lieu of the exfiltration testing, in which case the allowable leakage shall be the same as would be allowed for the Hydrostatic Test.

All testing shall be performed by the Contractor without any direct compensation being made therefore, and the Contractor shall furnish all necessary equipment and materials, including plugs and standpipes as required.

## 5.9 Air Test Method

The sewer pipe section under test shall be clean at the time of testing but the pipe may be wetted. Pneumatic balls shall be used to plug the pipe ends at manholes. Low pressure air shall be introduced into the plugged line until the internal air pressure reaches 5.0 psi greater than the average back pressure of any ground water pressure that may submerge the pipe. At least two minutes shall be allowed for the air temperature to stabilize before readings are taken and the timing started. During this time the Contractor shall check all plugs with soap solution to detect plug leakage. If plugs are found to leak, air shall be bled off, the plugs shall be retightened, and the air shall be reintroduced into the line.

The sewer section under test shall be accepted as having passed the air leakage test if it does not lose any pressure within the 5 minutes under test pressures. The gauge used for air testing shall have a 4" minimum face diameter with a 270 degree sweep. The graduations on the gauge face shall be marked in 0.01 psi increments. Total range shall be 0 to 10 psi.

## 5.10 Hydrostatic Test Method

After bulkheading the test section, the pipe shall be subjected to a hydrostatic pressure produced by a head of water at a depth of three feet above the invert elevation of the sewer at the manhole of the test section. In areas where ground water exists, this head of water shall be three feet above the existing water table.

The water head shall be maintained for a period of one hour during which time it shall be presumed that full absorption of the pipe body has taken place, and thereafter for an extended period of one hour the water head shall be maintained as the test period. During the one-hour test period, the measured water loss within the test section, including service stubs, shall not exceed the Maximum Allowable Loss (in Gallons Per Hour per 100 Feet of Pipe) as shown in Table 3 for the applicable Main Sewer Diameter.

Main Sewer Diameter (In Inches)	Maximum Allowable Loss* (In Gallons Per Hour Per 100 Feet)
6	.25
8	.30
10	.40
12	.50
15	.60
18	.70
21	.85
24 & Larger	.95

Table 3. Hydrostatic Test Allowable Loss

\*Based on 50 Gallons Per Day Per Pipe Diameter Inch Per Mile

If measurements indicate exfiltration within a test section is not greater than the allowable maximum, the section shall be accepted as passing the test.

#### 5.11 Test Failure and Remedy

In the event of test failure on any test section, testing shall be continued until all leakage has been detected and corrected to meet the requirements. All repair work shall be subject to approval of the Engineer. Introduction of sealant substances by means of test water shall not be permitted.

Unsatisfactory repairs or test results may result in an order to remove and replace pipes as the Engineer considers necessary for test conformance. All repair and replacement work shall be at the Contractor's expense.

#### 5.12 Televising

Sewer line televising shall be required by the Engineer, at the cost of the Contractor, if visual inspection, leakage testing, or deflection testing indicate the sewer has not been constructed in accordance with these specifications and the requirements of the Plans, Specifications, and Special Provisions or the sewer line has been damaged prior to final acceptance of the job and/or any of the referenced tests were unable to be performed fully and adequately as determined by the Engineer.

Contractor shall televise any section of pipe that has been improved by sanitary sewer spot repair, sanitary sewer replacement, pipe joint repairs or any other technique used in the field. At the end of all sanitary sewer work, the contractor shall deliver 1 DVD to the Engineer showing the improvements done in the field at least 48 hours prior to paving the

bituminous wearing course. The DVDs shall become the property of the owner.

#### 5.13 Ductile Iron Pipe

Ductile Iron Pipe used on this project shall be made in accordance with ANSI Specification A21.51 (AWWA C153-1A21.53).

If requested by the Engineer, the pipe manufacturer shall furnish to the Engineer a certified copy of all tests run on the pipe. All tests shall be observed and certified by an independent testing laboratory. Such laboratory shall be a member of the American Council of Independent Laboratories, Inc. The Engineer must approve the pipe based on the test results before any pipe may be shipped to the job. The decision of the Engineer shall be final with regard to the approval or disapproval of the test reports.

The cost of conducting the above tests, the observing and certification of same by an independent laboratory shall be paid for by the owner.

Ductile Iron pipe shall be cut only by sawing, milling or torch cutting in accordance with the manufacturer's recommendations.

Ductile iron pipe shall be class 150 and conform to the requirements of Federal Specifications WW-P-421 b with wall thickness in conformance with the requirements of ANSI Specification A21.1 for the laying condition and depth of cover required. All joints shall be mechanical joints in accordance with ANSI Specifications A21.11 with plain rubber gaskets.

#### 5.14 Ductile Iron Pipe Fittings

Ductile iron fittings shall be a minimum of Class 350 for sizes up to and including twelve inches (12") and Class 150 for sizes fourteen inches (14") and larger. Fittings shall conform to the requirements of ANSI Specification A21.53 (AWWA C153).

D.I.P. fittings shall be ductile iron with dimension tolerances, joints and linings as specified in ANSI Specification A21.53 (AWWA-C153) and ANSI Specification A21.4 (AWWA/ANSI C104). The Ductile Iron pipe shall be cement lined, mechanical joint or slip joint.

Cor-Blue T-bolts with Protecto Caps shall be used on all mechanical joints. No other type of bolts shall be allowed unless approved by the Engineer.

All pipe and fittings shall be coated inside and outside for corrosion resistance. Mastic spray is to be used where any uncoated pipe or fitting is exposed such as welds, megalugs, scraped coating, etc.

#### 5.15 Jointing Materials

##### Clay Pipe

Clay pipe joints shall be made with materials having resilient properties in conformance with ASTM Designation C425 for Type 1 and Type III.

##### Concrete Pipe

Reinforced concrete pipe shall have o-ring R-4 joint gaskets. The rubber gaskets shall be designed in accordance with ASTM Designation C443, with dimensions approximately as shown on Minnesota Standard Plate No. 3006G.

##### Ductile Iron Pipe

Joint material shall be mechanical joint with plain rubber gasket or slip joint.

#### 5.16 Precast Concrete Manholes

All manholes, catch basins and drop inlets shall be precast reinforced concrete. Precast concrete manhole sections shall be manufactured to standards at least equal to or greater than the requirements of the Standard Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, ASTM Designation C478, the internal diameter shall be forty-eight inches (48") or as specified in the Plans. Precast top and lower sections for manholes shall conform to requirements as shown on detail drawings and in accordance with MnDOT Standard Plates. Shallow structures may require that the structure be precast with an over depth and the over depth sump filled in with cement grout to satisfy this requirement. This over depth and grout shall be considered incidental.

Joints and all manhole riser sections shall be gasketed in accordance with ASTM Designation C443. All manholes shall have gaskets.

#### 5.17 Precast Manhole Bases

Precast manhole bases shall be used and shall conform to requirements as shown on detail drawings and in accordance with MnDOT Standard Plates. Depending upon soil conditions, 1/4 cy concrete grout may be required by Engineer. Cost is incidental to manhole.

### 5.18 Manhole Castings

Castings for manhole frames and covers shall be manufactured in accordance with MnDOT Standard Specification (3321) and shall be free from all injurious defects and flaws in conformance with Federal Specification AA-1-652. All castings shall conform to the dimensions shown on the detail drawings and the total unit weight shall not be less than the minimum weight specified on said drawings. All covers must fit closely in the rings in any and all positions, and, when placed in the rings, must fit to the ring solidly in all positions, so there will be no rocking from pressure applied on any point on the cover. Covers shall bear the word "Storm or Sanitary" on top. All sanitary sewer castings shall be Neenah Type R-1728 or R-1733 (based on manhole opening) with a "self-sealing" solid cover (two (2) concealed pick holes), or approved equal.

### 5.19 External Frame Seal

Frame seals shall consist of a flexible external rubber sleeve, interlocking extensions and stainless steel compression bands as manufactured by Cretex Specialty Products or a pre-approved equal conforming to the following requirements. The seal shall remain flexible throughout a 25 year design life, allowing repeated vertical movement of the frame of not less than 2 inches and/or repeated horizontal movement of not less than 1/2 inch. The sleeve portion of the seal shall be corrugated with a minimum unexpanded vertical height of either 6 inches or 9 inches and shall be capable of being mechanically locked to the manhole frame. The sleeve and extension shall have a minimum thickness of 3/16 inches and shall be made from a high quality rubber compound conforming to the applicable requirements of ASTM C-923, with a minimum 1500 psi tensile strength, a maximum 18% compression set and hardness (durometer) of 48+/-5 DURO. The bands shall be integrally formed from 16 gauge stainless steel conforming to ASTM A-240, Type 304, with no welded attachments and shall have a minimum adjustment range of 2 diameter inches. Any screws, bolts or nuts used on this band shall be stainless steel conforming to ASTM F-593 and 594, Type 304.

All castings, rings, and adjustments shall include furnishing and installing an external seal on all sanitary manholes. The permanent seal shall externally seal the adjustment ring area and joint sections of the manhole. Seals shall be installed per manufacture's specifications. The seal shall use an Infi-Shield, Chimney Seal or approved equal external sealing method and shall include an integral seal with the casting assembly and structure joint below the adjustment rings.

## 5.20 Adjusting Rings

Concrete adjusting rings of the same size as the cone or slab opening shall be used. Concrete adjusting rings shall be used on storm and sanitary structures. HDPE adjusting rings are not authorized for use.

All casting assembly & install casting shall include total replacement of the existing rings and interim adjustment to bring the casting to finish grade.

Castings shall be brought to bituminous base course grade no sooner than 48 hours prior to paving. All castings shall be protected with a Type I barricade with a functioning flasher facing the direction of traffic. It is the responsibility of the Contractor to protect the raised castings from damage and to protect the manhole from debris at no cost to the Owner.

Castings shall be brought to final wear course grade no sooner than 24 hours prior to paving final wear course by utilizing cast iron manhole adjusting rings manufactured by Neenah Enterprises Inc. R-1979 Series Manhole Adjusting Rings or an approved equal. Casting and ring shall be cleaned with a grinder or wire brush to remove tar, dirt, rust, and foreign material and then brushed clean with a whisk broom. Apply a 3/8" bead of EBS Super Glue around the edge of the frame and bearing surface. Center the adjustment ring on the frame and replace the manhole cover. Keep traffic off the manhole for a minimum of 8 hours.

All material removed to adjust manhole rings and/or casting will be removed of and disposed of by the contractor. The area will be backfilled with Class 5 or Class 7 aggregate material and compacted to 100 percent density. No additional compensation will be made for any costs associated with the removal and replacement of the roadbed material.

## 5.21 Cementitious Manhole Liner

This work shall consist of installing a monolithic, fiber-reinforced, structurally enhanced, cementitious-based liner material by spray application to the wall and bench surfaces of a brick/block manhole with a 1-foot overlap on precast elements to prevent infiltration. Liner will not be applied to precast elements except for overlap. Water used for mixing shall be clean and potable.

Materials shall be from a single manufacturer and be compatible with the manhole substrate and with each other. Manufacturer shall be BASF SP15 or approved equal. The liner material shall be a fiber-reinforced, spray applied, cementitious mortar with the following properties.

1. Minimum Compressive Strength, ASTM C 109: 9,000 psi at 28 days
2. Minimum Tensile Strength, ASTM C 496: 700 psi at 28 days
3. Minimum Flexural Strength, ASTM C 78: 1000 psi at 28 days
4. Shrinkage, ASTM C596: 0 percent at 28 days, 90 percent relative humidity
5. Minimum Bond, ASTM C882: 2250 psi at 28 days
6. Applied Density: 133 plus or minus 5 pounds per cubic foot
7. Freeze/Thaw Resistance, ASTM C 666, Method A: 100 cycles, no visible damage
8. Factory Blended: Requires only addition of water at site.

#### 6.0 CONSTRUCTION STAKES, ALIGNMENT AND GRADES

All work under this contract shall be constructed in accordance with lines and grades shown on the drawings and as established by the Engineers. These lines and grades may be modified by the Engineers as provided in the Contract. The Contractor shall furnish at his/her own expense such materials and render such assistance as may be required for setting lines and grade stakes, batter boards, templates, patterns, platforms, reference points, or other marks or points of line or grade.

The Contractor shall give the Engineer 48 hour notice of the Contractor's need for the establishment of line and grade. After lines and grades for any part of the work have been given by the Engineer, the Contractor shall be held responsible for the proper execution of the work to such lines and grades and all stakes or other marks given shall be protected and preserved by the Contractor until authorized removal by the Engineer. The Contractor shall at his/her own expense, correct any mistakes that may be caused by their unauthorized disturbance or removal. The Engineer may require that work be suspended at any time when for any reason such marks cannot be properly followed.

No additional compensation shall be allowed the Contractor for any claims of crews being held up because of lack of line and grade stakes.

#### 7.0 EXCAVATION AND PREPARATION OF TRENCH

The trench shall be dug to the alignment and depth shown on the plans and only so far in advance of pipe line as the Engineer shall permit. The sides of the trench shall be sloped and/or braced and the trench drained so that workers can

work safely and efficiently. It is essential that the discharge pumps be laid to natural drainage channels or to drain sewers.

In all cases where the sewer alignment is located so that space and access is very limited with respect to the safety and welfare of adjoining buildings, such as a property line between houses, the Contractor shall discontinue open trench excavation and shall jack the pipe in place for an adequate length to safeguard settlement and damage to these adjacent structures at no extra compensation.

The trench widths at the top of the excavation may vary depending upon the depth of trench and the nature of the material encountered. However, the maximum allowable width of trench at the level of the top pipe in place shall be as indicated in Table 4.

<b>Pipe Sizes - Inside Diameters</b>	<b>Width of Trench at Top of Pipe</b>
33" and Less	Outside diameter of pipe + 16"
36" and Larger	Outside diameter of pipe + 24"

Table 4. Trench Excavation Width for Sewer Pipe

For trench widths at the top of pipe greater than specified in the paragraph above, the Contractor may propose alternate strength of pipe to depth of cover relationships other than those specified under Article No. 5 "Materials for Sewers" of these Specifications, listed on the Proposal Form or shown on the plans. Such proposals must be submitted to the Engineer for approval in writing and with pertinent pipe strength and soil weight data and proposed trench width at the top of pipe at least fourteen (14) days prior to the desired construction date. No extra compensation shall be allowed for any increase in material or construction costs created by alternate plans.

The trench shall have a bottom conforming to the grade to which the pipe is to be laid. The pipe shall be laid upon sound soil, cut true and even so that the barrel of the pipe will have a bearing for its full length. If excavation is made below grade, it shall be backfilled with well tamped pit run sand or fine gravel as approved by the Engineer at no additional expense to the City.

Bell holes shall be dug at the ends of each length of pipe to permit proper jointing. Excavations for manholes and other structures shall have one-foot minimum clearance on all sides.

The Contractor shall provide without additional compensation suitable temporary channels for any water that may flow along or across the site of the work. The excavated material shall be placed on one side of the trench except when permitted by the Engineer to use both sides. All material shall be so placed as not to obstruct any drain or gutter, or to unnecessarily obstruct any passageway.

When existing sewers have to be taken up and removed, the Contractor shall at his/her own cost and expense provide and maintain temporary outlets and connections for all private or public drains and sewers. The Contractor shall also maintain all sewage and drainage which will be received from these drains and sewers; and for this purpose the Contractor shall provide and maintain, at his/her own expense, adequate pumping facilities and temporary outlets or diversions. The Contractor at his/her own expense shall construct such troughs, pipes, or other necessary structures, and be prepared at all times to dispose of drainage and sewage received from these temporary connections until such time as the permanent connections are built and in service. The existing sewers and connections shall be kept in service and maintained under the contract except where specified or ordered to be abandoned by the Engineer. All water or sewage shall be disposed of in a satisfactory manner so that no nuisance is created and so that the work under construction shall be adequately protected.

All surplus material shall be removed by the Contractor and disposed of at no additional compensation.

## 8.0 PIPE FOUNDATIONS

If the Contractor encounters unstable soil not suitable for bedding of pipe, the Contractor shall remove and replace all unstable material with stabilization material as may be ordered by the Engineer. The Contractor shall not be paid extra for such additional excavation, but shall be paid for additional base stabilization material at the unit price bid. Material for base stabilization shall be two-inch (2") binder stone or pit run gravel as determined by the Engineer.

If the Engineer considers that the specified pipe, as shown on the plans, is not suitable for the sub-grade soil condition, the Engineer may order the Contractor to install ductile iron pipe in lieu of the specified pipe to be placed on rock stabilized sub grade or on piling as specified below.

### 8.1 Piling

Norway Pine, Jack Pine, Douglas Fir (Coast Region) or Southern Yellow Pine, may be used under these Specifications. Balsam, Fir, Hemlock, Soft Maple, Poplar, Slippery or Swamp Elm, or any other wood which would not stand driving shall be rejected.

All piles shall have a butt diameter of not less than 12". Piles less than 40 feet in length shall have a top of not less than 8 inches diameter and piles over 40 feet long shall have a tip not less than 7 inches in diameter.

Piles shall be sound and solid and free from any defects which may materially impair their strength or durability. They must be so straight that when a line is drawn from the center of the butt to the center of the tip, the

line shall be within the body of the pile and shall have a uniform taper from the tip to the butt.

Piles shall be capped and cradles provided in accordance with the detailed drawings.

All piles, caps, and ties shall be treated in conformance with Minnesota Department of Transportation Specification 3491.

The Contractor shall furnish, place and drive piles as directed by the Engineer. All piling shall be driven to substantial refusal as defined by Minnesota Department of Transportation Specification 2452.3. Piles shall be driven vertically in exact position at locations given by the Engineer. Piles which may become shifted must be removed and good piles driven in their places or additional piles put in as directed by the Engineer without additional expense to the City.

#### 9.0 PUMPING, BAILING AND DEWATERING

The Contractor shall, at his/her own expense, pump or otherwise remove any water which may exist in the trenches and shall form all dams or other works necessary for keeping the excavation clear of water during progress of the work. This work may be required to proceed for 24 hours as directed by the Engineer.

The dewatering item shall only be used for additional dewatering needs above and beyond normal construction practices as described herein. Normal construction practices include use of up to two 3" trash pumps in the excavation in crushed rock sumps. The dewatering item shall only include the additional pumps, well points, manifolds, and other materials required.

#### 10.0 ROCK EXCAVATION

When the trench is carried through rock, the depth of excavation shall be 6" below the outside barrel of the pipe, fittings, and other appurtenances. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes. Sand shall be backfilled and tamped to proper grade before the pipe is laid. Width of excavation shall be computed on a basis of a uniform width 9 inches greater than the outside diameter of the hubs or bells of pipe.

Rock excavation shall be defined as removal of all boulders larger than one (1) cubic yard in volume and of ledge rock, concrete, or masonry structures that require an air hammer or blasting to remove.

Loose, soft or disintegrated shale or rock in its natural state, masonry or concrete which can be economically removed without air hammer or blasting shall be

classified as "loose rock" and no additional compensation shall be provided for excavation of this character.

#### 11.0 UNFORESEEN UNDERGROUND OBSTRUCTIONS

The removal of old timber, artificial loose stone or concrete fill or other man-made obstructions that hinders the normal progress of the excavation, other than utility lines, shall be classified as "Removing Unforeseen Obstructions". The removal shall be paid for at actual cost plus 15 percent, as provided in the General Conditions.

#### 12.0 SUBSURFACE DRAINS

Sub-surface drains shall be constructed in accordance with the provisions of MnDOT 2502 SUBSURFACE DRAINS (2016 Edition) and as modified below:

All subsurface drains will be terminated at a storm structure. Drilled or preformed holes in the drainage structure are required for all connections to minimize structure damage. In addition, the joint is to be mortared both inside and outside of the structure wall where the drainpipe goes into the structure. Rodent screens will be provided at all open ends (i.e. in structures) of the pipe drain. Connecting the subsurface drain to new or existing structures shall be considered incidental.

#### 13.0 SHEETING AND BRACING

The Contractor, to prevent the disturbing or settlement of adjacent road surfaces, foundations, structures, or railroad tracks or other improvements, shall furnish and place all sheeting and bracing necessary to good working conditions acceptable to the Engineer and to prevent damage and delay to the work. The Contractor shall be responsible for the strength and sufficiency of all sheeting and bracing. Should the Engineer decide that the sheeting and bracing at any point is inadequate or improperly constructed, the Engineer may order additional sheeting or bracing to be placed at the Contractor's expense.

Bracing shall be so arranged as to provide ample working space and so as not to interfere with the work and so as not to place any strain on the structures being constructed until such structures are, in the opinion of the Engineer, of ample strength to withstand such strain. All sheeting and bracing, unless otherwise specified or ordered to be left in place by the Engineer, shall be installed and removed from the work at no additional compensation. No sheeting and bracing shall be removed until the construction has proceeded far enough to provide ample strength in the opinion of the Engineer.

Any damage to the work under this contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, caves or other causes

due to failure or lack of sheeting and bracing or improper bracing or through negligence or fault of the Contractor in any manner shall be repaired by the Contractor without delay at his/her expense.

Where the trench is not located near existing utilities, buildings or other structures and where water and other conditions permit, the Contractor may with the approval of the Engineer, omit sheeting and bracing of the excavation. In this event, the Contractor shall excavate a space of sufficient size to provide adequate space for the construction work so as to prevent sliding or caving of the banks into the area within the lines of structures.

The Contractor shall leave in place to be imbedded in the backfill of the trench all sheeting and bracing, etc., which the Engineer may direct in writing to be left in place for which the Contractor shall be paid. In addition to that sheeting and bracing mentioned above, the Contractor may also leave in place, to be imbedded in the backfill of the trench, any sheeting and bracing which he/she may consider necessary to prevent injury to person, structures, corporations or property, whether private or public, for which he/she assumes the entire and sole liability for any damage which may be caused by the installation, and for which he/she shall receive no payment or extra compensation.

No sheeting and bracing which is within 3 feet of the surface of the ground may be left in place in the trench without written permission from the Engineer. When sheeting and bracing have been ordered left in place, payment for same shall include the upper 3 feet or "cut-off" section of the sheeting. This upper three feet (3') or "cut-off" shall be Contractor's responsibility to dispose of at no additional cost.

#### 14.0 TEMPORARY BRIDGES AND CROSSINGS

The Contractor shall construct and maintain temporary bridges and crossings, complete with flaggers, wherever necessary to expedite the work or to maintain traffic. Temporary bridges or crossing shall be of ample size to safely carry the load which may come upon them as determined by the Engineer. The cost of all labor, material, tools and equipment for temporary bridges and crossings shall be borne by the Contractor, and no separate or additional payment shall be made therefore.

#### 15.0 RAILROAD AND HIGHWAY CROSSINGS

During the construction of work underneath and alongside railroad tracks and County or State Highways, the Contractor shall conduct all his/her operations with due caution in regard to the safety of lives and property and for the maintenance of railroad and highway traffic. The method and construction required for any work under or adjacent to railroad tracks and highways shall be in accordance with the respective railroad or highway department involved. The

railroad and/or highway department may provide such inspectors or watchers as, in their opinion, are required, the expense of which shall be paid for by the Contractor. The Engineer shall make all arrangements therefore with the above named concerns, and the Contractor shall notify the Engineer in writing at least fifteen (15) days before proceeding with any work on or under said property concerned, stating the time and place where the Contractor shall interfere with the above company's property. In those cases where the issuance of a permit to do work in the above designated right-of-ways requires cash deposit or bond, the Contractor shall furnish said cash deposit or bond.

## 16.0 INSTALLATION OF SEWER AND APPURTENANCES

Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work.

Pipe and other materials shall be unloaded and distributed on the job in a manner approved by the Engineer. In no case shall materials be thrown or dumped from the truck. All materials unloaded in an unsatisfactory manner shall be rejected and work shall be stopped until such materials have been examined by the Inspector and approved. The Contractor shall furnish the necessary assistance in such examination of materials.

Sewer materials shall be carefully lowered into trench piece by piece by means of suitable tools or equipment, in such a manner as to prevent damage to materials and protective coatings and lining. Under no circumstances shall sewer materials be dumped into the trench.

### 16.1 Laying and Bedding of Pipe and Fittings

Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect any cracks. Any defective, damaged or unsound pipe shall be rejected.

All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and shall be kept clean during and after laying. All openings along the line of the sewer shall be securely closed as directed. In the suspension of work at any time, suitable stoppers shall be placed to prevent earth or other substances from entering the sewer.

All pipes shall be bedded as per Class C Bedding, unless otherwise directed by the Engineer. Class C is that method of bedding trench pipes in which the pipe is placed with ordinary care in an earth foundation, shaped to fit the lower part of the pipe exterior with reasonable closeness for a width of at least 50% of the pipe breadth. The remainder of the pipe

is surrounded to a height of at least twelve inches (12") above its top by granular materials, shovel placed and shovel tamped, to fill completely all spaces under and adjacent to the pipe. The fill is tamped thoroughly on each side and under the pipe as far as practicable in layers not exceeding six inches in thickness.

In the event that suitable, fine granular and granular material is not encountered during the normal excavation of the sewer trench or when the material encountered is determined unsuitable by the Engineer for backfilling around the pipe as required for Class C Bedding, the Contractor shall provide and place such approved material (sand fill) as required at the unit price bid.

Pipe laying shall proceed upgrade with the tongue or spigot ends pointed in the direction of the flow. No pipe shall be laid in water or when the trench conditions are unsuitable for such work, except by permission of the Engineer.

This Contractor shall make all of the connections of pipe to the manholes that have previously been constructed. The Contractor shall receive no extra compensation for connections to capped stubs or cutting into existing manholes unless specifically indicated otherwise in the Proposal. For completing drop sections for drop manholes Contractor shall be paid as per unit price bid.

Connections to existing manholes shall be core drilled with rubber boots.

Sanitary sewer spot repair work includes installing less than 50-feet of new PVC sanitary sewer trunk pipe or service pipe of compatible interior diameter to the existing pipe and connecting the new pipe to the existing pipe with Fernco 5002 Series Strong Back (RC) couplings except at PVC to PVC connections. The sanitary sewer work shall be coordinated with the Engineer and property owners prior to removal. To effectively perform the repairs, it may be necessary to provide for by-pass pumping of storm water or sewage flows.

## 16.2 Jointing of Pipe and Fittings

### Concrete Pipe

Reinforced concrete pipe shall have R-4 Joint Gaskets per ASTM C443.

### Ductile Iron Pipes

Ductile iron pipes shall be jointed with mechanical joints using rubber gaskets. Jointing shall be done in accordance with "Notes on Method of

Installation" included in ANSI Specification A21.11 for a mechanical joint or slip joint pipe (see water main specifications for jointing procedure).

### PVC

Connections shall be push-on with elastomeric gasket joints which are bonded to the inner wall of the gasket recess of the bell socket. Unless otherwise specified, all pipe and fittings shall be push-on with snug fit elastomeric joints meeting tightness requirements of ASTM 3212.

### Corrugated Polyethylene (HDPE)

Couplings and Connections shall be made with bell and spigot joints. Bell and spigot joints shall use a gasket if necessary to make the joint soil-tight.

When a watertight joint is specified in the Plans, it shall be required that the joint meet the requirements of ASTM D3212 except as modified. The internal pressure test shall be performed at 68 kPa (**10 psi**) (minimum) with the pipe in straight alignment. The vacuum test is not required. The Engineer shall be provided a laboratory certification that the pipe coupler for each size of pipe meets or exceeds these requirements. The Engineer shall also be furnished shop drawings of each pipe coupler.

## 16.3 House Services

It shall be the duty of the Contractor to cooperate with the City and keep an accurate record of service connections as to location, depth to top of connection, type of connection provided, etc. Location shall be made in respect to the nearest manhole center down grade from the service. This record shall be kept jointly by the Contractor and Engineer. Sewer services shall be located at least 10 feet, measured horizontally, away from existing water services and for the most convenience to the benefited property.

At all service locations, unless otherwise designated on the plans or by the Engineer, the Contractor shall construct services from the following approved materials: Ductile iron, or SDR 26 PVC in either 6" or 4" size as required or as indicated on the plans. The Contractor shall extend services to the property line unless otherwise directed.

Wherever possible, house connections shall be kept to a minimum depth of ten feet (10') over the top of the pipe in the street and not less than nine feet (9') over the top of the pipe at the curb line and shall extend on a straight line grade to the property line unless otherwise directed by the Engineer.

Where the depth of cover over the top of the sewer pipe in the street is twelve feet (12') or more, the Contractor shall construct the service connections up the side of the trench with a 45 degree bend and riser pipe to a minimum depth of cover over top of pipe of ten feet (10') and extend the service horizontally to the property line with minimum depth of cover over top of pipe of nine feet (9'), at the curb line as described above.

All house connections shall be capped with a plug sealed firmly in place or other method approved by the Engineer which will prevent any water entering the sewer until the connection is placed in service.

The Contractor shall provide all necessary wyes or crosses for connecting services to clay sewer pipe, cast iron sewer lines, and reinforced concrete sewer lines, etc. This work shall be considered incidental unless otherwise indicated in the Plans and Contract. The Contractor shall provide bends to bring services to the proper location and elevation.

At the end of all house connections, the Contractor shall install at no additional compensation steel fence posts set vertically to within 3 inches of the ground surface on a developed lot or at least 3 feet above ground on an undeveloped lot.

#### 16.4 Manholes

Excavation shall be to a depth and size to provide for construction of the manhole as shown in detail on the plans.

If approved by the Engineer, a cast-in-place, reinforced concrete base for manhole construction shall be of size and depth as shown on detail drawings. Concrete used for this purpose shall be 3000 p.s.i., air-entrained sand and gravel concrete. Material used for this purpose shall be subject to the approval of the Engineer. Base shall be poured on undisturbed earth. All manhole walls shall consist of precast concrete.

All manhole frames and covers shall be installed using adjusting rings and an external seal in accordance with Articles 5.19 and 5.20. Manhole frames and covers shall be set to the designated elevation in a full mortar bed where concrete adjusting rings are approved for use. Provide a minimum quantity of rings to achieve the designated elevation. Rings may be of varying depth. The contractor shall notify Engineer if the total height of adjusting rings needed exceeds 2-feet.

The bottom of all junction manholes shall be shaped to conform to the pipe so as to allow a free, uninterrupted flow of sewage.

#### 16.5 Drop Manholes

Wherever drop manhole sections are left for future construction, the drop shall terminate at the vertical stack (no tee) approximately 12 feet below the road surface. These drop sections and all stubs shall be tightly capped with an approved cap. Drop manhole sections to be immediately connected under this contract or those requiring capped stubs, as noted on the plans, shall be constructed complete with tee section as detailed.

#### 16.6 Submittals for all Manhole Frame Seals

The manufacturers of all manhole frame seals shall submit certification to the Engineer stating that their product meets the design life, performance and applicable material requirements of this specification.

#### 16.7 Sump Drain, Sump Drain Cleanout, and Sump Drain Inlet

This shall include all work necessary to provide sump pump drains as indicated in the plan. This work shall include, but not be limited to all equipment, labor, and materials necessary to complete the work as specified.

Cleanouts shall be installed at all dead ends and locations in lengths of pipe greater than 300-ft for maintenance purposes. When the cleanouts are in the catch basin or manhole a rodent guard that swivels up to allow trash to pass through shall be installed.

Services installed under roadways shall be insulated with 4" insulation (4'x8'x2" sheets). Granular bedding shall be used under the insulation where clay soils exist.

Service inlets shall include a 1.5' stub beyond the curb or walk (whichever is greater) and capped and marked as indicated on Standard Plate 241. Services shall include the tee, pipe, cap and marker.

Any tees or bends installed with the main line piping shall be incidental mainline pipe drain.

Tracer wires shall be laid with the pipe and shall be Copperhead High Strength Tracer Wire, part # 1230-HS, direct burial #12 AWG Solid (0.0808" diameter), 21% conductivity copper-clad hard drawn high carbon steel extra high strength horizontal directional drill tracer wire, 452 pound average tensile break load, with a 30mil HDPE insulation, or approved equal as approved by the Engineer.

For horizontal directional drill operations, tracer wire shall be Copperhead Extra High Strength steel #12 AWG copper clad steel part #1245-EHS, minimum 45mil HDPE insulation thickness with minimum breaking strength of 1,150 pounds, or approved equal as approved by the Engineer. The conductor insulator shall consist of a high molecular weight-high density green polyethylene jacket complying with ASTM-D-1248, 30 volt rating.

Termination of the tracer wire shall be at all clean outs and storm sewer structures. Connectors shall be DryConn 3-way direct-bury lug part #3WB-01, Copperhead 3-way locking connector part #LSC1230\* or approved equal. The tracer wire shall be incidental to the sump drain installation.

The terminations shall reflect Standard Plate 110 tracer wire access box or approved equal and shall be installed 3" below finish grade elevation. When connecting near a catch basin, the termination cap will be directly behind the back of curb line and in the middle of the 2x3 casting. The Contractor shall provide Valvco type tracer wire access box or approved equal as approved by the Engineer. This work shall be considered incidental.

Tracer Wires shall be tested for electrical continuity. The electrical test shall be made after the entire sewer has been installed and connected at both ends. If the test is a failure the contractor shall make the corrected measures as directed by the engineer and be at no cost to the owner. Any damage that has occurred during the installation of the tracer wire shall be repaired at no cost to the owner.

Drilled or preformed holes in the drainage structure are required for all connections to minimize structure damage. In addition, the joint is to be mortared both inside and outside of the structure wall where the drainpipe goes into the structure. Rodent screens will be provided at all open ends (i.e. in structures) of the pipe drain. This work shall be considered incidental.

#### 16.8 Polystyrene Insulation

This work shall consist of furnishing and installing four inch (4") thick insulation board above the watermain and sewer pipe at the locations designated in the Plan. This work shall be performed in accordance with the details shown in the Plans, the applicable MnDOT Standard Specifications, and the following:

The insulation board shall be rigid expanded polystyrene conforming to the material requirements of MnDOT 3760. Styrofoam S.M. and Styrofoam TG brand insulation is an approved insulation material.

The insulation material shall be furnished in panels 50 mm [**2 inch**] thick and shall be placed on a smooth level foundation in a staggered manner that will provide joint overlaps a minimum of 150 mm [**6 inches**] on the underlying sheets and the edges shall be trim and square. A minimum of two (2) wood skewers per board in each layer driven flush with the surface of the material shall be utilized to hold the insulation material in place during the backfill operations.

The placement of the backfill material over the insulation board and compaction thereof shall be accomplished in a manner that will preclude damage to the insulation material. Construction equipment of any kind shall not operate directly on the insulation board. Sections of insulation board damaged by the Contractor's construction operations shall be replaced at the Contractor's own expense.

Measurement will be made by the area insulated as specified. Payment will be made under Item 4" Polystyrene Insulation at the Contract bid price per square meter [**square yard**], which shall be compensation in full for all costs incidental thereto.

#### 16.9 Cementitious Manhole Liner

The Contractor shall submit the manufacturer's product data, including physical properties, surface preparation, repair, application, curing, and field quality control. The Contractor shall submit a minimum of 3 previous rehabilitation projects including contact information, and project data. The Contractor shall submit the applicators qualifications such as operator name, experience, and training in the application of the specified products along with reference contact information.

Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. Materials shall be stored in accordance with manufacturer's instructions.

Materials shall not be applied if ambient temperature is below 40 degrees F and if surfaces are frozen or expected to freeze within 24 hours after application. Mix temperature shall be kept below 90 degrees F at time of application and water temperature shall not exceed 80 degrees F.

The Contractor shall prepare the surfaces in accordance with the manufacturer's instructions. Covers shall be placed over the invert to prevent extraneous material from entering sewer lines during cleaning and spraying of manhole walls. Manhole walls and bench shall be cleaned

using a minimum of 1,500 psi water spray to remove contaminants, dirt, debris, and other foreign materials and loose, unsound, and protruding brick, mortar, and concrete.

The Contractor shall stop active leaks prior to liner application using a chemical grout. The grout shall be applied according to the manufacturer's instructions. All grouting to stop active leaks shall be incidental to the cementitious liner.

All voids and surface defects greater than ½-inch deep shall be repaired using a high strength non-shrink hydraulic cement prior to liner application. All repairs of defects greater than ½-inch shall be incidental to the cementitious liner.

The Contractor shall install the cementitious liner before the placement of the bituminous wear course. The Contractor shall get approval from the Engineer to line following the placement of the bituminous wear course.

The liner material shall be applied in accordance with manufacturer's instructions using approved equipment, designed and manufactured by the material manufacturer for the specific application.

Liner material shall be spray applied by hand (no machine spinning) in 1 or more passes from bottom of wall up to and including all cementitious adjusting rings to form a structurally enhanced monolithic liner minimum total thickness of ½ inch. Spray bench of manhole with liner material to produce a gradual slope from walls to invert and with uniform radius' at the intersection of the wall and bench.

Core Samples shall be taken from 2 percent of lined manholes completed. If minimum thickness is not achieved, another ½ inch shall be applied to all structures at the Contractors expense.

Sprayed liner material shall be troweled to a relatively smooth finish without over troweling and a brush finish applied to the finished surface.

Materials shall be cured in accordance with the manufacturer's instructions. Minimize exposure of applied materials to sunlight and air movement to 15 minutes before covering or closing access and allow a minimum of 8 hours cure time before subjecting manholes to flows. Visually verify absence of leaks following curing.

The Contractor shall provide four (4) 2-inch cubes to be submitted to the Engineer for compressive strength testing.

#### 17.0 DRAINAGE STRUCTURE DESIGN SPECIAL (GRIT CHAMBER)

The structures shall be commercially available products that are fabricated and constructed in accordance with the applicable provisions of MnDOT 2506, such as

ecoStorm® storm water treatment system, as specified by ConTEch, StormCeptor, V2B1 Stormwater treatment system as specified by Environmental 21, or an approved equal, the manufacturer's recommendations, and as directed by the Engineer. The structures shall also comply with the following requirements:

- A) The structure shall provide the means to remove and contain sediment, oils, and fuels, from stormwater runoff during frequent wet weather events. Based on the TSS gradation shown in Table 1 and tributary area characteristics shown in the special provisions, the structure must be capable of an annual average removal of Total Suspended Solids (TSS) referenced in the special provisions. The specific gravity of suspended solids shall be assumed 2.65 and the kinematic viscosity of water shall be based upon a water temperature equal to daily average St. Paul air temperature during the analysis period for annual average modeling.

Particle Diameter	Percent of Sediment Finer
1000	100
500	95
250	90
100	60
50	45
8	20
2	5

- B) The structure shall be non-mechanical and gravity-flow driven, requiring no external power. The structure must not block or clog or have a reduction in treatment capacity during normal operation. The structure must treat all flows up to the treatment flow rate determined by the manufacturer to meet the TSS removal requirement. The structure must remove grease, oil and fuels from the stormwater runoff without the use of sorbent material.
- C) All gaskets between precast sections shall be specifically designed to be resistant to hydrocarbons.
- D) The structure shall be designed and constructed so that it can be accessed and inspected, and also maintained from the surface without requiring entry into the structure. All access covers must be clearly marked to indicate that the structure is an oil/sediment retainage structure. Precast concrete and manhole frames and covers must be fabricated in accordance with ASTM standards for H-20 loading. Frames and castings must be placed with consideration for future maintenance and cleaning. At a minimum, openings must be provided for each location requiring maintenance and must include a means of access as approved by the Engineer.
- E) Inlet and outlet pipes shall be securely set in the structure using grout or approved pipe seals so that the structure is watertight. Sealing boots are acceptable. All lift holes shall be filled flush with mortar and sealed.
- F) The structure and castings, regardless of its location in relation to the roadway, shall be capable of withstanding a ten ton roadway design load.
- G) The bidder must ensure that the structure can be constructed within the Right-of-Way and permanent easements shown in the Plans, does not conflict with either existing or proposed utilities, and fits the designed pipe alignments unless otherwise approved by the Engineer. Flow line elevations at the outlet end of discharge pipes shall remain unchanged and any changes in pipe must be approved by the Engineer.

- H) The storage sump must be sized so that it is capable of storing a volume of material that would allow the structure to be fully functional if cleaned only once a year. The manufacturer shall review the storage requirement of the device with the Engineer. The storage sumps shall be designed to accommodate an amount of sediment determined upon the calculated removal efficiency at an assumed influent TSS concentration of 200 mg/L. Storage volume for captured oils and other floatables shall also be adequate for annual removal without entrainment under baffle.
- I) The manufacturer of the structure must guarantee all parts of the system to be free from defects in materials and workmanship for a period of two years following installation. Equipment supplied by the manufacturer must be installed and used only in the particular application for which it was specified.
- J) The manufacturer must submit a "Manufacturer's Performance Certificate" certifying that the unit achieves the specified removal efficiencies listed in these specifications. As part of the "Manufacturer's Performance Certificate": the manufacturer must include a copy of the model results from the most current version of SHSAM (Sizing Hydrodynamic Separators and Manholes) showing compliance with TSS removal requirements. Annual average TSS removal shall be based upon Golden Valley, MN rainfall data for the period 1995 through 2007 with temperature data from St. Paul during the same analysis period. The removal efficiency shall include washout as given in the updated version of SHSAM. SHSAM is available from Barr Engineering Company and is based upon the results of University of Minnesota testing as described in Assessment of Hydrodynamic Separators from Storm Water Treatment, ASCE Journal of Hydraulic Engineering (May 2009) and Hydraulic Analysis of Suspended Sediment Removal from Storm Water in a Standard Sump, J. Hydraul Eng (2012.138:491-502).
- K) Detailed shop drawings, sizing computations and efficiency documentation sufficient to verify compliance with all portions of this specification must be certified by a licensed Engineer in the state of Minnesota and submitted to the Engineer for approval prior to constructing the structure. The manufacturer shall also supply an operations and maintenance manual for the specific treatment device supplied. A final copy of all shop drawings, computations, and documentation incorporating any changes or corrections must be provided by the manufacturer for inclusion in the project maintenance manuals.
- L) Bid Items have been provided for Construct Drainage Structure Design Special (Grit Chamber). Measurement and payment will be lump sum for furnishing and installing all equipment, materials and labor for the grit chamber(s). This includes, but is not limited to, excavation, compaction, subgrade base, cleaning structure(s), piping fittings, frames, castings, protection of existing utilities, riser sections, adjusting rings, stairs disposal of excess material, adjusting casting elevations, and all other work required to construct the grit chamber(s), complete in place as specified.

## 18.0 PIPE JOINT REPAIR

Intent: The intent of this section is the elimination of infiltration into sewers that are otherwise structurally sound.

The Contractor is responsible for any cleaning or root cutting prior to any pipe joint repair.

Equipment: The basic equipment shall consist of a closed circuit television system, necessary chemical sealant containers, pumps, regulators, valves, hoses, etc., and joint sealing packers for the various sizes of sewer pipes. The packer shall be cylindrical and have a diameter less than the pipe size and have cables attached at each end to pull it through the line. The packer device shall be constructed in a manner to allow a restricted amount of sewage to flow. Generally, the equipment shall be capable of performing the specified operations in lines where flows do not exceed the maximum line flows for joint sealing. Jetting or driving pipes from the surface that could damage or cause undermining of the pipe lines shall not be allowed. Uncovering the pipe by excavation shall not be allowed.

Chemical Sealing Materials: The chemical grout shall be of a type which has a documented record of satisfactory performance in sewer usage.

All grouting materials shall be delivered to the job site in the original, labeled, and unopened containers. The chemical grout(s) selected by the Contractor is subject to approval of the Engineer. Grouts shall be one of the following types:

- 18.1 Acrylic base gel chemical sealing material - Avanti AV-122 or equal
- 18.2 Urethane base gel chemical sealing material - Avanti AV-310 or equal
- 18.3 Acrylamide Base Gel Sealing Material – In accordance with ASTM F 2304-03

Contractor will also need to use a root retardant at the very end of the job to ensure help with keeping roots out of the sanitary sewer system.

Joint Sealing Procedure: Pre-cleaning of the sewer lines for mineral deposits and root buildup at the joints shall be the responsibility of the Contractor.

The sewer lines shall be jet cleaned immediately by the Contractor prior to testing/sealing as required to remove solids and allow for proper seating of the sealing packer and operation of the televising camera. Water required for cleaning shall be provided by the Owner.

The packer shall be positioned over the joint by means of a measuring device and the closed-circuit television camera in the line. It is important that the procedure used by the Contractor for positioning the packer be accurate to avoid over pulling the packer and thus not effectively testing and sealing the intended joint. The

packer ends (end elements, sleeves) shall be expanded using controlled air pressure. The expanded ends shall seal against the inside periphery of the pipe to form a void area at the joint, now completely isolated from the remainder of the pipe line. Into this isolated area, sealant materials shall be pumped through the hose system at controlled pressures which are in excess of groundwater pressures. The pressure device shall accurately show p.s.i. to the nearest one tenth (0.1) pound and shall instantly respond to and record any change in the void pressure. The joint shall be tested with a gauge pressure of one-half ( $\frac{1}{2}$ ) p.s.i. per foot of depth of sewer as measured by the deeper of the two manholes between which the sewer section is located, or a minimum of four (4) p.s.i., whichever is larger. The pumping unit, metering equipment, and the packer device shall be designated so that proportions and quantities of materials can be regulated in accordance with the type and size of the leak being tested or sealed.

The grout sealant shall be applied until it is determined that the pressure cannot be built up in this void or until the test pressure is reached as recorded by the void pressure monitor. When either of these conditions is reached, the grout sealant supply shall be shut off. If no pressure can be built up, the joint will have failed the test. The joint will also have failed the test if the pressure drops more than one (1) p.s.i. in 15 seconds or two (2) p.s.i. in 30 seconds. Any joint failing the test shall be sealed and retested utilizing the same method and procedures until it does pass the test. The cost of retesting sewer joints shall be considered incidental and included in the cost of sealing sanitary sewer joints.

For the unit price bid for "Pipe Joint Repair", the Contractor shall furnish all materials, labor, and equipment to complete all work as specified. The diameter of the sewer line to be sealed is as listed in the Proposal. The Contractor shall be paid for all joints successfully sealed and retested that initially failed the pressure testing.

It is realized that this test and seal method may only be used on sewer pipe sections in sound physical condition. When bell cracks or chips are evident from pipe section offset, sealing may be undertaken where the offset is small enough to all proper seating of the sealing packer on both sides of the joint to be sealed.

Circular Cracks: Circular cracks in the sewer pipe shall be sealed using the same procedures specified for sealing joints. Payment for sealing of circular cracks shall be the same as for testing and sealing joints.

Joint Sealing Verification: Upon completing the sealing of each individual failed joint, the packer shall be deflated until the void pressure meter reads zero pressure, and then re-inflated and the joint retested. Should the void pressure meter not read zero, the Contractor shall clean his equipment of residual grout material or make the necessary equipment repairs/adjustments to produce accurate void pressure readings. Joints that fail to meet the specified test criteria

shall be resealed and retested until the test criteria can be met in order to receive payment.

Residual Sealing Material: Residual sealing materials that extend into the pipe, reduce the pipe diameter, or restrict the flow shall be removed from the joint and disposed of by the Contractor at an approved site. The sealed joints shall be left reasonably “flush” with the existing pipe surface. If excessive residual sealing materials accumulate in the line (and/or if directed by the Owner/Engineer), the manhole section shall be cleaned to remove the residual materials.

Flow Control: To effectively conduct sealing operations, it may be necessary to provide for flow control or pumping of sewage flows. The Contractor shall be responsible for providing the means and equipment for such flow control or pumping. The Contractor shall be responsible for damages to property due to sewer backup while controlling sewage flow. All costs for flow control, temporary pumping, etc., shall be considered incidental and included in the unit prices bid for other items.

When sewer line flows are above the minimum requirements (generally not more than 1/4 of the pipe diameter) or inspection of the complete periphery of the pipe is necessary to effectively conduct the sealing operations, one or more of the following methods of flow control shall be used at no extra cost to the Owner.

Plugging or Blocking. A sewer line plug shall be inserted into the line at a manhole upstream from the section to be tested and/or sealed. The plug shall be so designed that all or any portion of the sewage flows can be released. Flows shall be restored to normal or not more than 1/3 of the pipe diameter during the joint testing and joint sealing operation.

Pumping and Bypassing. Where pumping is required, in the opinion of the Engineer, to assure completion of the sealing work, the Contractor will be required to furnish pumping equipment, pipes, etc. Under no circumstances will bypassing of untreated wastewater to any storm drainage facility or surface water course be allowed.

Records: Complete records shall be kept of joint sealing performed in each section. The records shall identify the section in which the sealing was done, the location of each joint sealed, and the joint sealing verification results. Two neatly bound set of these records shall be delivered to the Owner at project completion.

Re-Test: Pressure test 10% of the sewer joints which have been previously sealed. Testing shall be done no sooner than 90 days but within one year after joints were originally sealed. Sections of sewers to be tested will be selected by the Owner. Joints that fail the re-test will be re-sealed. If 10% or more of the re-tested joints fail, an additional 10% of the entire project will be re-tested and re-sealed as needed. If more than 10% fail the second re-test then all joints involved

in the project will be re-tested and sealed as necessary at no additional cost to the owner.

Guarantee: All sewer pipes joint sealing work performed shall be guaranteed against faulty workmanship and/or materials for a period of one year after the completion of the work. A televised inspection will be made at the end of all sanitary improvements, spot repairs and joint repairs to make sure all debris is out of the sanitary mainline.

## 19.0 CURED IN PLACE PIPE LINING

This work shall include all work necessary to construct and install an approved lining system using materials for the rehabilitation of existing sewer pipes – Cured in Place Pipe (CIPP). The qualifications for installers of approved lining materials shall include having installed a minimum of 200,000 linear feet of the Approved Lining Material. Installation of the CIPP shall be in accordance with ASTM D543 Test Method for Resistance of Plastics to Chemical Reagents ASTM D638 Test Method for Tensile Properties of Plastics, ASTM D790 Test Method for Tensile Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials and ASTM F1216 Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin-Impregnated Tube. It is the intent of this specification to provide for the rehabilitation of pipelines and conduits by the installation of a resin-impregnated flexible tube which is inverted into the original pipeline/conduit and expanded to fit tightly against said pipeline/conduit by the use of water or air pressure. Other installation methods shall be upon specific approval by the Engineer.

A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:

- a) No later than 5 days prior to the start of work, a written notice to be delivered to each home affected by the CIPP lining describing the work, schedule, how it affects them, and a local telephone number of the Contractor they can call to discuss the project or any problems which could arise. The telephone number of the City's Project Representative and the City's 24 hour emergency telephone number shall also be listed.
- b) No later than 5 days prior to the start of work, a written notice to the homes located within two pipe lengths of the CIPP lining describing the work and possible odors they may encounter during this work.
- c) Written notice and attempted personal contact at least 24 hours in advance to the beginning of work being conducted on the section relative to the residents affected.

- d) Personal contact with any home whose service for any reason cannot be reconnected within the time stated in the written notice.
- 19.1 Submittals – The following shall be submitted to the Engineer for approval prior to installation and repairs being performed:
- A. Product Data:
1. Manufacturer's product literature, application and installation requirements for materials used in liner.
  2. Manufacturer's product certification for materials used in liner.
  3. Liner Pipe Thickness Design.
    - A.3.1 Liner Pipe Thickness Design shall be in accordance with Appendix XI of ASTM F1216. The existing pipe *shall not* be considered as providing any structural support to the liner pipe. In the liner thickness calculations, the minimum ovality of the host pipe shall be 5 percent, the enhancement factor (K) shall not be greater than 7.0, the minimum safety factor shall be 2.0, and the flexural modulus of elasticity shall be reduced 50% to account for long term effects and used in the design equation  $E_L$ .
    - A.3.2 No liner shall be installed until it has been approved for installation.
    - A.3.3 No liner will be approved for installation until liner thickness calculations have been submitted and reviewed for conformance with the specifications and installation requirements. The calculations shall be completed by a registered professional engineer proficient in the design of CIPP pipeline systems.”
- 19.2 If the Contractor utilizes air inversion and steam cure method for CIPP installation, a typed document prepared in an outline format describing the Contractor's procedure for executing steam cure. The procedure described in the typed document must include, but shall **not** be limited to, a discussion of the Contractors:
- A. Steam cure safety methods.
  - B. Cool-down period activities that follow the post-cure period that will prevent thermal shock to the CIPP liner.

- C. If the Contractor will water inversion and cure method for CIPP installation, a typed document prepared in an outline format describing the Contractor's procedure for executing this method. The procedure described in the typed document must include, but shall **not** be limited to, a discussion of the Contractors:
1. Safety methods in the event of water spillage onto the ground surface and resulting possible icing conditions, and
  2. Management of possible odor build-up in homes.

19.3 Installer:

- 19.3.1 Proposed plan for dewatering and bypassing sanitary sewer during liner installation.
- 19.3.2 Evidence of the Installer's experience with cured-in-place pipe rehabilitation method shall contain a list of projects, including location and contact, completed with the approved material (minimum 200,000 linear feet).
- 19.3.3 If Installation is by "Water Inversion and Cure Method", the Installer's evidence shall feature 5 projects similar in scope to this project that were accomplished by the Installer. 3 of the projects must have been in the State of Minnesota. For each of the 5 projects, submit the project's location, name and telephone number of the owner, dates the project was accomplished, and the length and size of the rehabilitated pipe.

19.4 If Installation is by "Air Inversion and Steam Cure Method", the Installer's evidence shall feature:

- 19.4.1 Five projects featuring Air Inversion and Steam Cure Method for pipes less than or equal to 9-inch inside diameter that were accomplished by the Installer. Three (3) of the projects must have been in the State of Minnesota. For each of the 5 projects, submit the project's location, name and telephone number of the owner, dates the project was accomplished, and the length and size of the rehabilitated pipe.
- 19.4.2 Five projects featuring Air Inversion and Steam Cure Method for pipes greater than or equal to 24-inch inside diameter that were accomplished by the Installer. 3 of the projects must have been in the State of Minnesota. For each of the 5 projects, submit the project's location, name and telephone number of the owner, dates

the project was accomplished, and the length and size of the rehabilitated pipe.”

19.5 Post Lining Submittals:

18.5.1 Testing results per the *Field Quality Control* section (see below).

18.5.2 CCTV DVD's and reports (pre & post lining) per the *Field Quality Control* section (see below).

19.6 Quality Assurance:

19.6.1 Corrosion:

A. Fabricate finished liner from materials which, when cured, will be chemically resistant to withstand internal exposure to storm water runoff.

B. Manhole Connections

C. All manhole connections shall be water tight.

19.6.2 Testing:

A. Test finished pipe liner in accordance with the *Field Quality Control* section (see below).

19.7 Materials:

19.7.1 Resin:

19.7.2 Polyester resin for general chemical applications:

A. Up to 5% by mass thixotropic agent which will not interfere with visual inspection may be added for viscosity control.

B. Resins may contain pigments, dyes or colorants which will not interfere with visual inspection of cured liner.

19.7.3 Reinforcing Material:

A. Non-Woven, needle interlocked polyester felt formed into sheets of required thickness.

B. Felt tubes may be made of single or multiple layer construction, with any layer not less than 1.5 mm thick.

C. Mechanical strengthener membrane or strips may be sandwiched in between layers where required to control longitudinal stretching.

1. Liners shall have a bonded internal polyurethane membrane, which must be left on the internal surface of liner after curing.
2. Minimum thickness of bonded polyurethane membrane and inner liner, shall be 0.3 tenths of an mm, +5%, and shall not affect structural dimension requirements of cured liner.

19.7.4 Felt Content:

- A. Content shall ensure cured thickness of liner as specified.
- B. Thickness of cured liner to be as specified (+10%-4%) and shall not include thickness of polyurethane inner liner.

19.7.5 Resin Content:

- A..10 to 15% by volume greater than volume of felt in liner bag.

19.7.6 Cured liner shall conform to minimal structure standards listed:

	<u>Standard</u>	<u>Value</u>
Tensile Strength	ASTM D638	3,000 psi
Flexural Modulus of Elasticity	ASTM D790	250,000 psi
Flexural Strength	ASTM D790	4,500 psi

19.7.7 Fabricate liner to size that when installed will fit internal circumference of pipe. Allowance shall be made for circumferential stretching during insertion.

19.7.8 Meet requirements of ASTM F-1216.

19.8 Preparation:

19.8.1 Prior to liner installation, sufficiently remove protruding taps, mineral deposits, roots and other debris from sewer line to the industry standard of 95% of the pipe diameter.

19.8.2 If offset joints or collapsed pipe sections are present that will prevent insertion of the liner - Notify the Engineer immediately. Repairs for these conditions are not part of the scope of this

project and will be completed only after the Engineer issues written authorization.

#### 19.8.3 Sanitary Sewer Bypassing:

- A. Provide for bypass pumping of existing sanitary sewer.
- B. Provide for flow of sewage around sections of pipe to be lined.
  - 1. Pump or bypass lines shall be of adequate size and capacity to handle existing flow.
  - 2. Coordinate bypassing operations with Engineer and property owner.

#### 19.9 Installation:

##### 19.9.1 Preparation of Liner:

- A. Resin Impregnation:
- B. Designate location where uncured resin in original containers and unimpregnated liner will be vacuum impregnated prior to installation. Installer shall allow engineer to inspect materials and "wet out" procedure.
  - 1. Resin and catalyst system compatible with requirements of this method shall be used. Quantities of liquid thermosetting materials shall be to manufacturer's standards to provide lining thickness required.
  - 2. Following submittal of manufacturer catalyzed stability (pot life) recommendations by the Contractor and approval by the Engineer, liner tube shall be impregnated with resin in accordance with manufacturer recommendations and stored out of direct sunlight at temperature less than 40 degrees Fahrenheit (4 degrees Celsius).
  - 3. Transport resin impregnated liner to site immediately prior to inversion in suitable light-proof container with temperature maintained below 40 degrees Fahrenheit (4 degrees Celsius).

## 19.10 Insertion of Liner:

19.10.1 Insert liner through an existing manhole or other access by means of an inversion process and application of hydrostatic head sufficient to fully extend liner to next designated manhole or termination point or by means of winching the liner through the last pipe to the next designated manhole or termination point. Lubricant may be used.

## 19.10.2 Curing Liner:

- A. After inversion is complete, provide heat source and water recirculation equipment. Equipment shall be capable of delivering hot fluid (air or water) throughout section to uniformly raise the fluid temperature above the temperature required to effect cure of resin.
- B. Temperature gauges shall be placed to determine the temperature of the incoming and outgoing fluid (air or water) from the heat source. Gauges shall also be placed at the upstream and downstream ends of the reach of pipe being lined to monitor the pressurized fluid's (air or water) temperature. In addition to monitoring the temperature inside the tube, temperature gauges shall be placed between the host pipe and the liner at as many points as is practical to record the heating that takes place on the outside of the liner.
- C. The Contractor shall maintain the Manufacturer's (Licensor's) recommended hydrostatic pressure (using water or air) and temperature throughout the curing process and for the duration recommended by the Manufacturer (Licensor).
- D. Initial cure shall be complete when inspection of exposed portions of liner to be hard and sound and remote temperature sensor indicates that temperature is of magnitude to realize an exotherm.
- E. Cool hardened liner to temperature below 100 degrees F before relieving static head in inversion standpipe. Cool down by introduction of cool water into inversion standpipe to replace water being drained from downstream end. Care shall be taken in release of static head so that vacuum will not be developed that could damage newly installed liner.

## 19.11 Connections:

### 19.11.1 Service Connections:

- A. Locations:
- B. Determine service connection locations from television inspection video tapes.

### 19.11.2 Reinstatements:

- A. Reinstate and reconnect service connections unless service connection is deemed to be inactive.
- B. Reconnect services without excavation by television camera and cutting device that re-establishes services for minimum of 95% of the flow capacity.
- C. Sanitary services shall not be out of service for more than 24 hours during lining process.
- D. If the Contractor is unable to re-establish sewer service connections inside the pipe and excavation is necessary, the cost and liability of such excavation shall be the responsibility of the Contractor including any additional landscaping or turf establishment.

### 19.11.3 Manholes Connections:

- A. Reconstruct benches and channels in manholes with grout to match new invert elevations.
- B. At the connection to the manhole, provide a watertight seal between the host pipe and liner pipe.

## 19.12 Field:

### 19.12.1 Finished liner:

- A. Liner shall be continuous over entire length of insertion run and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes and delaminations.
- B. During curing process, gauge water tightness under positive head.

- C. Liner shall conform to shape of pipe existing before installation and not be out of round by more than 15%.

#### 19.12.2 Liner Thickness:

- A. Cured liner shall be accurately measured and shall not be more than 5% less than thickness specified.

#### 19.12.3 Felt and Resin Content of Liner:

- A. Visually inspect liner to ensure number of layers of felt conforms to specified number of layers and thickness.
- B. Calculate resin to felt ratio by weight.
- C. Ratio shall fall in range 1.0:1 to 1.15:1.

#### 19.12.4 Testing:

##### A. Flexural Strength and Modulus of Elasticity:

1. Testing shall be completed by a 3<sup>rd</sup> party in accordance with ASTM D790 (testing and costs for testing shall be incidental and included with this work item).
2. Specimens tested shall be actual thickness of fabricated liner.
3. Do not machine specimen on surface.
4. Make test with smooth (inner) face in compression using 5 specimens.

#### 19.12.5 CCTV Examination:

- A. Televiser interior of pipe before and after completion of work to determine lining conditions and provide DVD to Owner. The DVD shall become the property of the Owner.
  - a. Both the before and after inspections shall be on the same DVD. A typed inspection log shall accompany each DVD and summarize the results of each DVD.
  - b. Each DVD and typed log shall be clearly labeled with its contents.

19.13 Cleaning and Restoration:

18.13.1 At completion of work, remove rubbish, debris, dirt, equipment and excess material from site. Clean and restore adjacent surfaces soiled by and during course of work.

19.14 Measurement and Payment:

19.14.1 Materials and installation as described below:

- A. Mobilization and site preparation.
- B. Televising of sewer to determine installed conditions.
- C. Cleaning of existing sewers to condition necessary for proper installation of product.
- D. Determining if existing service connections are active or inactive.
- E. Placement of lining material within sewer.
- F. Bypass pumping, if required.
- G. Dewatering
- H. Sewer testing and internal inspections of installation.
- I. Cleanup.
- J. Other appurtenant and incidental work.

19.14.2 Measurement for Payment:

- A. Measure sewer on straight horizontal line along centerline of sewer.
- B. Do not include distance through manholes in measurement.

19.14.3 Payment:

- A. Include cost of work listed herein in appropriate unit price bid per linear foot.

## 20.0 BACKFILLING AND GRADING

Backfilling and grading shall be performed in accordance with the provisions of MnDOT 2503 and 2506 and as amended and modified herein.

All excavation in trenches shall be backfilled to the original ground surface or to such grades as specified or shown on the drawings. The backfilling shall begin as soon as practical after the pipe has been placed and shall thereafter be carried on as rapidly as the protection of the balance of the work shall permit.

Backfilling shall be done as completely as possible so as to prevent after settlement, compacting the materials to attain complete filling and using the best materials available for the purpose, free from boulders or stones. Depositing of the backfill shall be done so the shock of falling material will not injure the structure. Grading over and around all parts of the work shall be done as directed by the Engineer.

Complete cleanup shall proceed directly behind the backfilling to accommodate the return to normal conditions. Should the Contractor, in the Engineer's opinion, fail to diligently pursue the backfilling and cleanup, the amount of open trench at any one time shall be limited to 300 LF and the amount of work on which complete cleanup has not been accomplished shall be limited to 600 LF. The Contractor shall have sufficient equipment on the job to assure timely backfill and cleanup at all times. No trenches shall be left open over night. The Contractor shall take full responsibility for any mishaps that might occur for non-compliance of this requirement.

The lower portion of the trench around the pipe shall be backfilled in accordance with the requirements for Class C Bedding. Granular material, free from rocks and boulders, shall be carefully placed by hand simultaneously on both sides of the pipe to a height of at least one-foot (1') above the top of the pipe to completely fill all spaces under and adjacent to the pipe. Backfill shall be tamped thoroughly on each side and under the pipe as far as practicable in layers not exceeding six inches (6") in thickness. In the event that suitable, granular material is not encountered during the normal excavation of the sewer trench or when the material encountered is determined unsuitable by the Engineer for backfilling around the conduit as required above, the Contractor shall provide and place such approved material (sand fill) as required at the unit price bid. All clay and plastic pipes shall be bedded in sand six inches (6") under and to each side, and one-foot (1') above the top of pipe.

Succeeding layers of backfill may contain coarse materials, but shall be free from pieces of rock, frozen material, concrete, roots, blacktop chunks, stumps, rubbish and other similar articles whose presence in the backfill, in the opinion of the Engineer would cause settlement of the trench, or damage to the pipe. No black dirt, loam or other unsuitable materials shall be used as backfill in the top four feet

(4') of the sewer trenches lying in the paved portion of the street. Under no condition shall lumps of broken blacktop or other such material of a size larger than two inches (2") in diameter be placed in the upper one-foot (1') of the finished grade.

Backfilling of trenches in the traveled portions of the streets and under the curbs shall be accomplished in one-foot (1') lifts. Where there is granular soil, compaction shall be obtained in each lift using a vibratory compactor. Where there are cohesive soils, the compaction of each lift shall be obtained using a sheep's foot roller. No peat or other organic soils shall be backfilled under the traveled portions of streets.

Backfilling of all trenches other than the traveled portions of streets shall be accomplished in a maximum of three-foot (3') layers or lifts. Compacting shall be obtained using the appropriate type of compactor depending on the type of soil encountered. Compaction shall continue on each lift until no further settlement occurs.

Where, in the opinion of the Engineer, the native soil is unsuitable for backfill materials, it shall be the Contractor's responsibility to excavate the trench, haul away all unsuitable backfill material to such locations as designated by the Engineer, and backfill the trench in accordance with the specifications with all acceptable excess material which may be obtained from other trenches or excavations within the project area. Payment for truck hauling this material shall be made at the contract unit price bid for common excavation (vehicle measure). In the event that deficiencies still exist in the backfill of the trench, after all available excess material has been utilized as described above, the Contractor shall provide additional approved material as may be authorized and verified by the Engineer. Such material shall be furnished and placed at the contract unit price per cubic yard. Unsuitable material that is loaded in trucks and hauled away to the dump areas shall be paid for at the contract unit price bid for common excavation (vehicle measure). There shall be no pay for unsuitable material that is excavated and wasted in the immediate area.

All backfill material around manholes, catch basins, pipe or any other structures used in the plans shall be compacted by mechanical tampers approved by the Engineer. Rubber-tired equipment shall be used to backfill trenches where other equipment will damage existing bituminous surfaces or sod. Absolutely no bucket tamping will be allowed in any trench or backfilling any structure.

In addition to the blading and maintenance requirements specified under this article, the Contractor shall also be required to adequately control dust on the streets after compaction and grading when directed by the Engineer. When so directed by the Engineer, the Contractor shall provide one tank truck of adequate size with spray bar or other suitable equipment for sprinkling streets which shall be available at all times for street maintenance. If in the opinion of the Engineer,

the Contractor is not maintaining adequate dust control with one tank truck, the Contractor shall provide additional tank trucks at no additional compensation.

All deficiencies in the quantity of material for backfilling the trenches, or for filling depressions caused by settlement, shall be supplied by the Contractor. Any excess material shall be hauled away and deposited where directed by the Engineer at no additional compensation.

The Engineer may designate areas where excess material could be hauled within the City limits.

The Contractor shall remedy at his/her own expense any defects that appear in the backfill, and anything affected by the defect, for a period of one year following completion.

When the trench excavation for the sewer and appurtenances is within the right-of-ways of State or County, the backfilling of the trench, compaction of materials and subgrade preparation shall be done in strict accordance with the existing requirements and specifications of the State or County Highway Department at no additional compensation.

The Contractor shall provide one motor grader which shall be available at the project at all times for surface maintenance. If in the opinion of the Engineer, the Contractor is not maintaining the street surface sufficiently with one motor grader, the Contractor shall provide additional motor graders at no additional compensation.

In all cases, the Contractor shall grade the roadway after the trench has been backfilled, so that it shall provide full and adequate drainage and shall be passable to traffic at all times. Existing roadway material shall be adequately salvaged, stockpiled, placed and graded to cap off the backfilled areas for purposes of maintaining access and providing a drivable surface free of rutting and ponding of water. Segregating soils during these operations is a specific requirement to prevent contamination of the soils that are needed for these purposes. The Contractor shall maintain the roadway in a condition acceptable to the Engineer at all times until final acceptance of the entire work by the City. This work shall be considered incidental.

Additional import material needed for purposes of maintaining traffic shall only be authorized and used for the specific purpose of maintaining traffic when full and proper measures have been taken to salvage and use the existing roadway base materials and all on-site material has been exhausted. Payment for additional material shall only be upon specific approval by the Engineer and shall be included for payment under the bid item of similar material.

## 21.0 INFILTRATION AND INSPECTION

Upon the completion of the sewer construction and before any house services are connected, leakage tests shall be made to determine the amount of ground water infiltration into the sewers. Measurements shall be taken by means of 90 degree V-notch weirs placed in the lines. Measurements shall be taken at all points where in the opinion of the Engineers the flow of the water in the sewers is greater than the maximum allowable leakage. The maximum allowable rate of leakage shall be as follows:

The infiltration shall not exceed 50 gallons per inch of pipe diameter per mile per day for any section of the system.

When measurements indicate a leakage greater than the maximum allowable leakage, additional measurements shall be taken and continued until all leaks are located and the necessary repairs and corrective work have reduced the leakage in the section being tested below the maximum allowed by the specifications.

The Contractor shall furnish the weirs and other material and labor for placing the weirs in the sewer and shall assist the Engineers in making measurements. The Contractor shall receive no additional compensation for making the leakage tests or corrective work necessary to reduce leakage below the maximum allowed by the specifications.

Upon completion of the contract, the Engineer shall carefully inspect all sewers and appurtenances. Any cracked or broken pipe shall be removed and replaced with a sound one and the invert of the sewer shall be left clean from any obstructions throughout the entire line.

## 22.0 SURVEY QUALITY LOCATES

This work shall consist of the Contractor providing survey quality XYZ locates of the sanitary wyes, connection points with the existing sanitary sewer service pipe, and sanitary clean-outs installed at grade or cut off below grade, each end of each abandoned pipe, and storm sewer sump drain services and clean-outs prior to backfilling operations with the intent being that the locations can be inserted into the City of Edina coordinate system for ease of relocation if so required.

Locates must be shot using ground-based survey equipment with a tolerance of +/- 0.03 feet. GPS-based surveying equipment may not be used for locates. Horizontal and vertical control will be provided by the Engineer.

The Contractor shall provide a spreadsheet with the information in the following column headings:

1. Address
2. Item Located

3. X Coordinate
4. Y Coordinate
5. Z Coordinate

## 23.0 RESTORATION OF GROUND AND ROAD SURFACES

Wherever the surface of the ground is removed or disturbed by the Contractor's operations the Contractor shall restore, replace or rebuild all such surfaces to a condition at least equal to its condition at time of removal. Maintenance of streets and traffic shall comply with Section 5.6 "Traffic Control and Maintenance of Traffic" of the General Contract Conditions.

Unless otherwise specified or shown on the plans, the Contractor shall not be required to replace bituminous paving on City streets or State and County Highways when the alignment of the sewer and its appurtenances, as shown on the plans, is alongside or parallel to a paved roadway, but the proximity of such alignment to the paving does not warrant any damage or removal of such paving, the Contractor shall replace or repair the paving which the Contractor has removed or damaged at no additional compensation.

## 24.0 GAS SERVICE

Whenever, during excavation for the sewer, a house gas service line, which is part of the gas system, is encountered, the cost of cutting said service, providing temporary service and reconnecting house service shall be borne by the Contractor.

The Contractor shall cooperate with the local gas utility on this phase of the work. If any expense is incurred by the local gas utility in connection with such cutting and replacement of gas service lines it shall be chargeable to the Contractor.

It shall be the Contractor's responsibility to notify the local gas utility sufficiently in advance of the Contractor's proposed construction. The Owner shall not be responsible for any delay that the Contractor may encounter due to the failure on the part of the local gas utility to promptly do the necessary work.

The Contractor shall be held liable for any damage to gas mains and house services because of carelessness or negligence on the Contractor's part.

## 25.0 WORKMANSHIP AND CLEANUP

Upon completion of the contract, the Contractor shall dismantle and remove all construction plant, equipment, appliances, barricades and surplus materials; shall clean the sewers and other structures and all streets or other services used by the Contractor; and shall do such incidental work as may be necessary to

leave the work or any premises occupied by the Contractor in a neat workable condition. This work shall be done with a minimum of inconvenience to the public or public travel.

When defective work on utilities; watermain, storm and sanitary that is a danger to the public's wellbeing or health has been noticed, the Contractor has 4 hours to respond to the Engineer with detailed information on how and when they are going to fix the defective work. If the contractor does not repair the defective work within 24 hours of written or verbal notice, the City has the right to repair and bill the contractor for the work. If the City deems the defective work a public hazard, the City has the right to immediately repair the defective work and bill the contractor.

## 26.0 METHODS OF MEASUREMENT AND PAYMENT

### 26.1 Reinforced Concrete Sewer Pipe in Place

Reinforced concrete sewer pipe for all classes shall be paid for at the contract price per lineal foot, for each diameter of pipe furnished and according to the depth zone classification.

### 26.2 Polyvinyl Chloride Pipe (PVC)

Sewer pipe shall be paid for at the contract price per lineal foot, for each diameter of pipe furnished, and according to depth zone classification.

### 26.3 Corrugated Polyethylene Pipe

Sewer pipe shall be paid for at the contract price per lineal foot, for each diameter of pipe furnished, and according to depth zone classification.

### 26.4 Ductile Iron Sewer Pipe

Ductile iron pipe shall be paid for at the contract price per lineal foot for each diameter of pipe furnished and according to depth zone classification.

Unit prices shall include excavation, pumping, sheeting, pipe completely installed, and backfilling for Items "23.1" through "23.4". All measurements shall be made along the centerline of the pipe and from center of manhole to center of manhole or center to center of appurtenant structures. Depth zone classification shall be based on total depth of trench from the surface of the ground to the invert of the sewer, except where the Engineer orders extra depth to assure firm foundation for the pipe, in which case payment shall be made at the unit price according to the depth of trench of the upper limit but not of the lowest limit. As an example: 8'-10' classification shall be taken from 8.01' to 10.00' inclusive.

No deduction in depth shall be made for rock encountered in the trench above the designated grade.

26.5 Manholes

Manholes and Catchbasins shall be paid for in accordance with MnDOT Specification 2506.

26.6 Frame Seals and Extensions

All costs for furnishing and installing the external seals and adjusting rings shall be incidental and included in the unit price bid for each casting, casting assembly, adjustment, or other bid item as appropriate.

26.7 Drop Section for Drop Manholes

The drop section for outside drop manholes shall consist of a PVC bend, PVC tee, and length of SDR 26 PVC pipe as required, including concrete base and pipe support. Payment shall be at the contract unit price for vertical feet of drop section from center of incoming line to center of outlet of 90 degree bend. All drops shall be strapped to the manhole wall with 14 gauge stainless steel straps, 2' on center. All straps and hardware within the manhole shall be stainless steel. A full length of SDR 26 PVC pipe shall be installed from the tee so as to lay on undisturbed earth. Payment shall be at the contract unit price for lineal feet of PVC at the appropriate depth class.

26.8 Connection to Existing Drop Sections

A connection to an existing drop section shall consist of completing a drop section as described hereinbefore, by core drilling into the existing manhole and furnishing a tee completely installed and shall be paid for at the contract unit price. Any removal of, or addition to existing drop section shall be paid for as per Article "24.7."

26.9 Rock Excavation

Rock excavation shall be measured by volume in cubic yards, and shall be measured from the top of the rock to a point six inches (6") below and nine inches (9") on each side of the outside barrel of the pipe and shall be paid for in accordance with MnDOT Specification 2451.

26.10 Material for Stabilizing Pipe Foundation

Material used for refilling to pipe foundation grade to assure firm foundation for pipe shall be paid for at the contract unit price per measured cubic yard in place.

26.11 Piling

Pile bents shall be paid for at the contract unit price.

26.12 Sheeting

Sheeting ordered left in place shall be paid for at the contract unit price per thousand board feet for wood sheeting and square feet as measured/sheet installed for steel sheeting. This shall include all overlapping sheets. No payment shall be made for installing any sheeting.

26.13 Special Sections

Special sections shall be paid for at the contract price on a lump sum basis for all work and material necessary for the complete installation or construction.

26.14 Wyes, Tees and Special Fittings

Wyes, tees and special fittings shall be paid for at the contract unit price for each unit furnished of the size and classification specified on the proposal.

26.15 Pipe Bedding

Pipe bedding shall be paid at the Contract unit price/ton placed.

26.16 Adjusting Casting

All castings and valve boxes shall be adjusted to bituminous base course grade prior to placing the bituminous base course and adjusted to final wear course grade prior to placing the final wear course. These interim adjustments of appurtenances located within the street shall be to 1/4" and 1/2" below the pavement surface. Interim adjustments are required on all appurtenances located in areas where the permanent wear course may not be paved until the following construction season. All interim adjustments are considered incidental.

#### 26.17 SURVEY QUALITY LOCATES

Survey Quality Locates shall be measured on a lump sum basis based on a percent complete of the project and shall include all labor and equipment associated with gathering and tabulating survey quality locates for watermain, sanitary sewer, and storm sewer required items.

#### 26.18 Cementitious Manhole Liner

Cementitious Manhole Liner shall be measured on a per linear foot basis from the invert of the manhole to the bottom of the lowest plastic adjusting ring. Where lining overlaps on a precast element, measurement shall be from the invert of the manhole to the top of the 1-foot overlap.

Payment of Cementitious Manhole Liner shall include all labor, equipment, and materials associated with installing a monolithic, fiber-reinforced, structurally enhanced, cementitious-based liner material by spray application to the wall and bench surfaces of a manhole to prevent infiltration.

#### 26.19 Connect to Existing Storm Sewer

Connect to Existing Storm Sewer shall be measured on a per each basis.

Payment for Connect to Existing Storm Sewer shall include, but not limited to, all labor, equipment, and materials associated with connecting new storm sewer pipe or new drainage structures to existing storm sewer pipe or storm sewer structures to complete the work.

Subsurface drains and sump connections to existing storm sewers are considered incidental to the installation and are not paid under this item.

#### 26.20 Sanitary Sewer Spot Repair

Sanitary Sewer Spot Repairs shall be measured on a linear foot basis and shall include all equipment, materials, and labor associated with removal and disposal of the existing sanitary sewer trunk or service pipe, bypass pumping, installation of new PVC sanitary sewer pipe, connections to the existing main pipe, reestablishment of flow, and backfill of excavation to proper compaction.

Whether or not a spot repair occurs at a manhole, the work shall include the removal and disposal of the existing pipe and if necessary the connection of the replacement pipe directly to the manhole.

Services and trunk pipe that are damaged by negligence shall be repaired by the Contractor at the Contractor's expense. Damage to property due to sewer backup while controlling sewage flow will be the responsibility of the Contractor.

27.0 MINNESOTA DEPARTMENT OF HEALTH, DIVISION OF ENVIRONMENTAL HEALTH SPECIAL REQUIREMENTS

Watermain crossing house sewers, storm sewers, or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the watermain and the top of the sewer. When local conditions prevent a vertical separation as described, the following construction shall be used.

27.1 Sewers passing over or less than 18 inches below watermain shall be constructed of materials equal to watermain standards of construction.

27.2 In addition, sewers passing over watermain shall be protected by providing: a vertical separation of at least 18 inches between the bottom of the sewer and the top of the watermain; adequate structural support for the sewers to prevent excessive deflection of the joints and settling onto and breaking the watermain; that the length of water pipe be centered at the point of crossing so that the joints shall be equidistant and as far as possible from the sewer.

27.3 Water main shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer, or sewer manhole, whenever possible. When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a storm or sanitary sewer provided that:

The bottom of the watermain is at least 18 inches above the top of the sewer.

Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to Water main standards of construction and shall be pressure tested to assure water tightness prior to backfilling.

[End of Sanitary Sewer, Storm Sewer & Appurtenances]