SECTION 33 31 00

SANITARY SEWER PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Sanitary sewer gravity pipe, fittings, and miscellaneous appurtenances.

B. The Contractor shall, unless specified otherwise, furnish all materials, equipment, tools and labor necessary to do the work required under the contract and unload, haul and distribute all pipe, castings, fittings, manholes and accessories. The Contractor shall excavate the trenches and pits to the required dimensions; sheet, brace and support the adjoining ground or structures where necessary; handle all drainage or ground water; lay and test the pipe, castings, fittings, manholes and accessories, backfill and consolidate the trenches and pits.

C. The Contractor shall also furnish all equipment, tools, labor and materials required to re-arrange sewers, conduits, ducts, pipes or other structures encountered in the installation of the work. All the above work to completely construct the sewer facilities shall be done in strict accordance with the project's contract documents to which these Specifications are a part thereof.

D. Related Sections
1. Section 02 41 13 - Selective Site Demolition.
2. Section 33 05 05 - Trenching and Backfilling.
3. Section 33 39 00 - Sanitary Utility Sewer Structures.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Sanitary Sewer Pipe
   a. Sewer pipe shall be paid for at the contract price per lineal foot, which shall include the cost of furnishing all pipe, pipe bend sections, jointing material, bedding material and other material and of delivering, handling, laying, dewatering, trenching, sheeting and backfilling, restoring of the surface, necessary permits, and all material or work necessary to install the pipe complete in place at the depth specified.
   b. The length of pipe for which payment is made shall be the actual overall length measured along the axis of the pipe without regard to intervening manholes, tee sections or bend sections.
   c. Lengths of branches will be measured from the center of manhole to the center of manhole. All lengths will be measured in a horizontal plane unless the grade of the pipe is more than fifteen (15) percent.
   d. The depth of cut for payment shall be defined as the distance between the invert of the pipe at a particular point and the intersection of a vertical or plumb line extended from the said point to the point of intersection of the line with the ground surface as it exists at time of construction.
2. Cast Iron Pipe or Ductile Iron Pipe in lieu of Other Sewer Pipe
   a. C.I.P. or D.I.P. not shown on the plans, but placed upon direction of the Engineer in lieu of other sewer pipe shall be paid for as sewer pipe in accordance with above plus the contract unit price per lineal foot bid as "Additional cost per foot for substituting C.I.P. or D.I.P. in lieu of other Sewer Pipe" as listed on the Proposal Form for the diameter of pipe furnished.

b. C.I.P. or D.I.P. fittings shall be paid for at the contract unit price per pound for the standard weight of fittings and specials installed, including glands, gaskets, bolts or other accessories

3. Connect to Existing Structure
   a. Measurement shall be on the basis of each and shall be considered to include all excavation, labor, materials, and equipment necessary to make the required connection including coring the structure when necessary.
4. Connect to Existing Pipe
   a. Measurement shall be on the basis of each and shall be considered to include all excavation, labor, materials, and equipment necessary to make the required connection.
5. Wyes
   a. Measurement will be based on units of each for each wye of each diameter and classification furnished and installed complete in place.
6. Insulation
   a. Measurement will be based on square yards of Insulation at the specified thickness. Payment will include furnishing and installation of the Insulation.

B. The furnishing and installing of specific items and/or performance of work under certain circumstances shall not be individually paid. The costs shall be included in the unit price bid for the sanitary sewer items, as indicated. Such items of work include but are not limited to:
   1. Dye water testing of all service lines encountered and the subsequent plugging of abandoned sewer services, include in the unit price bid for sanitary sewer.
   2. The costs of furnishing bends, adaptors, cutting and removing the existing sanitary or storm sewer pipe, include in the price bid for sanitary sewer.
   3. Locating and connecting to an existing sanitary or storm sewer service laterals, include in the price bid for sanitary sewer.
   4. Adaptors to adjust the diameter of the new service connections to match the existing service lines, include in the price bid for service connections.
   5. Leakage, vacuum, air and deflection testing, include in the price bid for sanitary sewer.
   6. The wood and/or metal parts necessary to identify the ends of unattached service lines, include in the price bid for sanitary sewer services.
   7. If a separate bid item for bypass pumping is NOT included in the *Schedule of Unit Prices,* providing temporary bypass pumping / control of sanitary and storm water flows around the construction zone, include in the price bid for the associated sewer items.
   8. Furnishing and installing tracer wire and electrical connections to interesting services and/or tracer wires, include in the price bid for sanitary sewer.
   9. Locating and connecting to an existing storm sewer, include in the price bid for storm sewer.
   10. Use of geotextile fabric to wrap pipe joints in lieu of using mastic, include in the price bid for storm sewer.
   11. Maintenance of an appropriate storm water outlet during construction, include in the price bid for storm sewer.
   12. The cost of all labor, equipment and materials necessary for testing of storm sewer, if required, included in the price bid for storm sewer.
   13. If the sewer is to be installed inside a casing pipe, furnishing and placing the carrier pipe, carrier pipe support materials, sand fill and grout seals, include in the unit price bid for sewer.
   14. If a separate bid item for bypass pumping is NOT included in the Schedule of Unit Prices, providing temporary bypass pumping / control of storm water flows around the construction zone, include in the price bid for the associated items being installed.

1.03 REFERENCES

A. MnDOT Specification No. 2520

B. MnDOT Specification No. 2451 shall apply to granular materials for foundation, bedding and encasement of utility line construction, except as modified herein.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.04 SITE CONDITIONS

A. Sanitary sewer lines are shown on the Drawings in a general way. Contractor should anticipate minor variations in both horizontal and vertical directions in locating existing system.

1.05 SUBMITTALS

A. Submit Product Data for the following items consistent with Section 01 33 00:
   1. Pipe and fittings.
   2. Transition couplings.
   3. Tracer wire.
   4. Any material not listed in PART 2 must have written approval by the City Engineer before it is incorporated into the work.

1.06 WARRANTY

A. The Contractor shall be held responsible for any and all defects in workmanship and materials which may be developed in any part of the entire installation furnished by the Contractor and upon written noticefrom the Engineer shall immediately replace and make good, without expense to the owner, any such faulty part or parts and damage done by reason of same, during the period as prescribed in Section 31 of the General Conditions.

B. Should the Contractor fail to make good the defective parts within a period of thirty (30) days of such notification, after written notice has been given to the Contractor, the Owner may replace these parts, charging the expense of same to the Contractor.

PART 2 PRODUCTS

2.01 GENERAL

A. The materials used in this work shall be all new, and conform to the requirements for class, kind, size, and material as specified below.

2.02 SOLID WALL POLYVINYL CHLORIDE (PVC) PIPE

A. 4" THROUGH 6" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ration (SDR) of 26, unless otherwise specified on the plans.

B. 8" through 15" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 35, for depths of less than 18 feet, unless otherwise specified on the plans. The SDR for depths exceeding 18 feet shall be 26, unless otherwise specified on the plans.

C. Over 15" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM F679 with a minimum wall thickness for a minimum pipe stiffness of 46.

D. WYES: All wyes shall be heavy wall and shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 26, unless otherwise specified on the plans.

E. The connection shall be push-up with elastomeric gasket joints, which are bonded to the inner walls of the gasket recess of the bell socket.

F. The pipe grade used shall be resistant to aggressive soil and corrosive substances in accordance with the requirements of ASTM D-543.

G. Polyvinyl chloride pipe joints shall be rubber gasketed push-on type joints conforming to ASTM D-1784. Joints supplied by the pipe manufacturer shall be installed according to their instructions.

2.03 DUCTILE IRON PIPE (DIP) AND FITTINGS

A. Ductile iron pipe shall be designed for a minimum working pressure of 150 pounds per square inch and shall conform to the applicable dimensions, weights and tolerances of Federal Specification WW-P-421b for cast iron pipe.

B. Ductile iron shall be Grade 60-42-10 with 40/90 metal strength and shall be tested in accordance with ASTM Specifications A339-55.

C. All pipe shall be cement lined inside and tar coated outside, meeting the requirements of AWWA C151-76.

D. Pipe Class: As shown on Drawings.

E. Ductile iron pipe shall be push-on type which comply with A.W.W.A. Specifications C-111 latest version. If used as a pressure line, an electrical contact must be provided through every joint.

2.04 HIGH DENSITY POLYETHEYLENE (HDPE)

A. Corrugated polyethylene pipe and fittings shall be manufactured from high-density polyethylene (HDPE) virgin compounds.

B. 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 requirements of these special provisions and in AASHTO M294 and Design Section 18 of the AASHTO Standard Specifications for Highway Bridges.

C. The polyethylene compounds shall conform to the requirements of ASTM D 3350 Cell Class 335420C.

D. HDPE shall be used only with site specific bedding requirements and written permission from the Engineer.

2.05 SUBSURFACE DRAIN PIPE / CONDUITS

A. 4” Perforated PE Pipe Drain (no sock)

B. 2” HDPE SDR 13.5 smooth/smooth for conduits

2.06 REINFORCED CONCRETE PIPE (RCP)

A. Reinforced concrete pipe and fittings including bends, tee sections and specials shall conform to:
   1. Standard Specification for Reinforced Concrete Sewer Pipe
   2. ASTM Designation C76 Wall B with circular reinforcing for the class of pipe specified.

B. Reinforced concrete pipe joints shall be Type R-4 meeting the requirements of ASTM C443.

C. Concrete pipe to be jacked shall be Class V or greater.

D. Pipe required for piling shall be reinforced concrete pipe furnished in (8) foot lengths and shall be of special design in accordance with Section 10, ASTM Designation C76, latest revision.

E. Concrete pipe bends called for on the plans shall be 7 1/2° pipe bends with a 4'-0" center line laying length and a 30.5' radius of curve, and with wall thicknesses and steel reinforcing in accordance with ASTM Specifications C76.
   1. Bends shall be of the same pipe class as the pipe on either side of the bend.
   2. Joints shall be tongue and groove with rubber gaskets meeting the requirements of ASTM C443.

2.07 TRACER WIRE

A. Tracer wire shall meet the requirements of one of the following:
   1. 1/8" galvanized aircraft wire clear PVC coated to 3/16".
   2. 1/8" 304 stainless steel wire clear PVC coated to 3/16".
   3. #12AWG solid copper or copper clad steel (CCS) wire with 30mil high density polyethylene (HDPE) insulating jacket.

B. Connectors shall be "wire nut" or "twist on" type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

2.08 INSULATION

A. Polystyrene Insulation: Extruded type conforming to ASTM C578, Type VI, VII, or V.

2.09 DIP ENCASEMENT

A. Material: Polyethylene film conforming to AWWA C105/A21.5 and ASTM A674, tube form.

B. AWWA/ASTM standard, corrosion protection warning and applicable range of nominal pipe diameter size(s) every 2 feet along its length.

2.10 TRANSITION COUPLING

A. Coupling consisting of an elastomeric sleeve with incorporating stainless steel tension bands, tightening mechanism, and less than 0.01 inch thick shear ring conforming to ASTM C1173, Type A.

B. Separate bushings are not allowed without approval from the Engineer.

C. Where dissimilar pipe materials result in offset flow lines, an eccentric coupler will be required and shall be approved by the Engineer.

2.11 CONTRACTOR'S RESPONSIBILITY FOR MATERIALS

A. Material Furnished by Contractor
   1. The Contractor shall be responsible for all material furnished by the Contractor, and the Contractor shall replace at the Contractor's own expense all such material that is found to be defective in manufacture or that has become damaged in handling after delivery by the manufacturer.
   2. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work or during the warranty period.

B. Material Furnished by Owner
   1. The Contractor's responsibility for material furnished by the Owner shall begin at the point of delivery by the manufacturer, or Owner, and upon acceptance of the material by the Contractor.
   2. The Contractor shall examine all material furnished by the Owner at the time and place of delivery and shall reject all defective material.
   3. The point of delivery shall be stated in the "Special Provisions".

C. Replacement of Damage Material
   1. Any material furnished by the Owner that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at the Contractor's own expense.

D. Responsibility for Safe Storage
   1. The Contractor shall be responsible for the safe storage of material furnished by or to the Contractor, and accepted by the Contractor, and intended for the work, until it has been incorporated in the completed project.
   2. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times.

E. Material Handling
   1. Pipe and other accessories shall, unless otherwise directed in the Special Provisions, be unloaded at the point of delivery, hauled to and distributed at the site of project by the Contractor.
   2. Materials shall at all times be handled with care to avoid damage.
   3. In distributing the material at the site, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
   4. Pipe shall be so handled that the coating and lining will not be damaged.
   5. If any part of the lining or coating is damaged, the repair shall be made by the Contractor at the Contractor's expense in a manner satisfactory to the Engineer.

PART 3 EXECUTION

3.01 PREPARATION

A. Excavation and Preparation of Trench: Conform to Section 33 05 05.

B. By-Pass Pumping: Contractor shall be responsible for all items required to maintain sewer flows during construction of the new sanitary sewer line. All Work and costs for this are considered incidental to the Project, unless otherwise specified.

C. Erosion control and dewatering in conformance with Section 01 57 13.

D. For offline sanitary sewer a pneumatic ball shall be utilized to plug the downstream side of the first manhole upstream of the connection to existing sanitary sewer.

3.02 PIPE INSTALLATION

A. Trench Excavation and Backfill: Conform to Section 33 05 05.
   1. Prior to the laying of the pipe, the trench shall be excavated and prepared in accordance with the previous specifications and the class of bedding specified.

B. All pipe shall be laid and maintained to the required lines and grades, with manholes, catchbasins and fittings at the required locations.
   1. The owner will furnish one set of line and grade stakes necessary for the work.
   2. It shall be the Contractor's responsibility to preserve these stakes from loss or displacement.
   3. The Engineer may order the replacement of any stakes deemed necessary for the proper installation of the work. Any replacements shall be at the Contractor's expense.
   4. All pipes shall be laid to the grade shown on the contract drawings.
   5. No deviation shall be made from the required line or grade except with the written consent of the Engineer.
   6. The Contractor shall maintain the line and grade of the pipe in the trench by means of the grade or batter board method or laser.

C. The type, size and class of pipe installed shall be in conformance with that specified.

D. The class of bedding shall be in conformance with that specified in the project specification or on the Standard Plates.

E. Pipe Jointing
   1. Pipe laying shall proceed upgrade with the tongue or spigot ends pointed in the direction of flow.
   2. All sliding surfaces of the joint shall be cleaned and lubricated immediately before the pipe is brought home.
   3. The outside of the tongue or spigot end of the pipe shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid.
   4. Joints for concrete pipe shall be made by wiping the joints clean, applying the manufacturer's recommended lubricant compound over the entire joint surface and then inserting the spigot end into the bell with sufficient force to properly seat the pipes.
   5. Joints for polyvinyl chloride pipe shall be made by the use of push-on rubber gaskets. All jointing procedure shall be in accordance with the recommendations of the pipe manufacturer.

F. 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 it shall be kept clean by approved means during and after laying.

G. The interior of the sewer shall be carefully cleaned from all dirt, cement, or superfluous material of every description as the work progresses. If necessary, pipe shall be thoroughly flushed at the completion of the work at the expense of the Contractor as directed by the Engineer.

H. If an existing utility is shown on the plans and there is no bid item for removing and restoring, or working around the utility, the Contractor shall be required to remove and restore, or protect the utility.

I. The inverts of existing sanitary sewers shall be protected during construction. The Contractor is responsible to inspect and clean, if necessary, all lines which have become compromised by the construction operations.

J. The trench for all flexible pipe shall be undercut six-inches below the pipe barrel to permit the installation of granular bedding or foundation material.

K. The trench for all rigid pipe shall be undercut three-inches below the pipe barrel to permit the installation of granular bedding or foundation material.

L. The Contractor shall install and operate a dewatering system to maintain all trenches free of water wherever necessary. The Contractor shall make his own subsurface investigations and determine what dewatering methods to utilize to prevent such damage.
   1. Pipe shall not be laid in water, or when the trench conditions are unsuitable for such work except by written permission of the Engineer.

M. The Contractor shall be responsible for any damage to adjacent structures or buildings caused by the dewatering operations.

N. Use of granular foundation material in lieu of performing dewatering is permitted.

3.03 CONNECT TO EXISTING SYSTEM

A. Connect to Existing Manhole
   1. Connect to existing structure at location shown on the Drawings.
   2. If rubber boot exists at manhole opening, connect new pipe to the boot and secure.
   3. If manhole opening does not contain rubber boot or the existing boot is damaged, core drill opening in the structure, and install a rubber boot in manhole opening prior to connection of pipe.
   4. Make repairs to the structure required due to the Work performed, including installation of doghouse.
   5. If necessary, the invert shall be reconstructed to accommodate new flow location. Reconstruction of invert will also be necessary if pipe sizes increase.

B. Connect to Pipe
   1. Connect to existing pipe at location shown on the Drawings.
   2. Remove existing plug.
   3. Ensure end of existing pipe is in good condition as approved by the Engineer.
   4. When connecting to existing pipe, saw cut existing pipe to provide a straight joint at connection and connect with a transition coupling.

3.04 MANHOLE INSTALLATION

A. Conform to the requirements of Section 33 39 00.

3.05 FIELD QUALITY CONTROL

A. GENERAL
   1. The Contractor shall furnish the weirs and other material and labor for placing the weirs in the sewers and shall assist the Engineer in making leakage tests and corrective work.
   2. The cost to the Contractor for the Contractor's labor and material to assist the testing and the Contractor's labor and material necessary to reduce leakage to allowable values shall be considered as incidental to the project without extra compensation to the Contractor.
   3. If 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 permanent corrective work necessary to reduce leakage below the maximum allowed by these specifications are completed.
      a. Each section of the project of a maximum length of 400 feet or the distance between two (2) manholes shall be required to comply with the below allowable rates of exfiltration.

b. The quantity of pipe used in these calculations is to include mains and street laterals only and is not to include house service laterals.

4. A low pressure air test will be required on all sanitary sewer construction.
   a. Other tests shall be as specified in the Special Provisions.
5. The cost of testing shall be considered incidental to the contract project.

B. EXFILTRATION TEST
1. Upon completion of the sewer and before any house services are connected, exfiltration tests may be made to determine the amount of exfiltration from the sewer line.
   a. The section of the sewer to be tested shall be sealed, and the manholes and pipe line to be tested shall be filled with water to a level or elevation specified by the Engineer.
   b. Measurements of the drop in water level shall be taken and recorded and the rate of leakage shall be thereby calculated.
   c. The maximum allowable rate of leakage shall be two hundred (200) gallons per inch of diameter of pipe per mile for twenty-four (24) hours where the maximum hydrostatic head at the centerline of the pipe does not exceed twenty (20) feet.

C. LOW PRESSURE AIR TESTING
1. Upon completion of the sewer and before any house services are connected to the pipe line, after the line has been backfilled and cleaned, the Contractor shall furnish all equipment and personnel necessary to conduct a "pipe line acceptability test" using low pressure air.
   a. This test shall be performed at a maximum distance of 400 feet between two manholes.
   b. The pipe line shall be sealed with a plug whose sealing length is greater than the diameter of the pipe and constructed in such a nature that they will not require external blocking or bracing and maintain a seal against the line's test pressure.
      1) All wyes, tees, outlet or ends of lateral services shall be suitably capped and braced to withstand the internal pressures. Such caps or plugs shall be easily removable.
   c. One (1) plug shall be tapped for the air supply hose and the return air pressure hose.
   d. The air supply hose, connected from the compressor to the plug, shall have a throttling valve, bleeding valve and shut off valve for control.
   e. The air pressure tap shall have a sensitive pressure gauge, 0 to 10 psi range, protected by a gauge cock and a pressure relief valve set at 10 psi.
   f. In performing the test, air is added slowly to the pipe line until pressure inside the pipe line reaches 4.0 psig.
      1) If air is added too rapidly, the test accuracy will decrease because a change in temperature also has an effect on the change in pressure.
   g. When the air pressure inside the pipe line reaches 4.0 psig above the external hydrostatic pressure the supply air is stopped.
   h. A time interval is allowed for the temperature difference to stabilize before the actual test is performed.
      1) If the air pressure drops below 3.5 psig during this time interval, more air will be supplied to the pipe line and throttled to maintain a pressure between 3.5 psig and 4.0 psig for a minimum of two (2) minutes after which time the supply air will be shut off.
2. The portion of line being tested shall be accepted if the portion under test does not lose air at a rate greater than 0.003 cfm per square foot of interval pipe at an average pressure of 3.0 psig greater than any back pressure exerted by ground water that may be over the pipe at the time of test.
3. The test shall be accomplished by determining the time in minutes for the pressure to decrease from 3.5 psig to 2.5 psig greater than the average ground water that may be over the pipe. That time shall not be less than the time shown for the given diameter in the following table.

PIPE DIAMETER IN INCHES	MINUTES
4	1.9
6	2.8
8	3.8
10	4.7
12	5.7
15	7.1
15	8.5
21	9.9

4. If the pipe line installation fails to meet the requirements of the test, the Contractor shall, at the Contractor's expense, determine the source of leakage, then repair or replace all defective material and/or workmanship.
5. In determining the pressure greater than the average ground water, the ground water height in feet above the pipe line must be measured. When the water elevation has been established, the height in feet above the pipe line shall be divided by 2.31 and that pressure added to gauge pressure of test.

6. A table for converting water height to gauge pressure is as follows:

GROUND WATER LEVEL OVER TOP OF PIPE	ADDED PRESSURE TO BE APPLIED TO GAUGE PRESSURE READINGS
1 FOOT	0.43 PSIG
2 FEET	0.86 PSIG
3 FEET	1.29 PSIG
4 FEET	1.72 PSIG
5 FEET	2.16 PSIG
6 FEET	2.59 PSIG
7 FEET	3.01 PSIG
8 FEET	3.44 PSIG
9 FEET	3.87 PSIG
10 FEET	4.30 PSIG

D. MANDREL TEST
   1. The owner reserves the right to check for excess deflection in any portion of the PVC sanitary sewer line after placement of the backfill material in the trench.
      a. The deflection will be checked by means of a mandrel device prior to final acceptance of the sanitary sewer line or within thirty (30) days of its installation.
      b. Deflections greater than 5% of the inside diameter of the pipe shall be considered failure of the bedding procedure.

E. TELEVISING

1. The Contractor shall televise, at the Contractor's cost, the sanitary sewer constructed in the project after completion of all the underground utility construction.
    a. The televising will be performed after the Class 5 material has been placed and before the first lift of base course bituminous asphalt.
    b. This information shall be considered part of the final inspection of the project.
2. Any line that has debris in the pipe shall be cleaned and retelevised, at the Contractor's expense, prior to placement of the first lift of base course bituminous asphalt.
    a. All dirt and debris shall be prevented from entering the existing sewer system by means of watertight plugs or other suitable methods.
    b. The Contractor must have written approval from the Engineer for the method they select to clean the line.
    c. The line will be retelevised at the time of final acceptance at the expense of the City of Northfield.
3. Camera System
    a. The television camera shall be mounted on a skid so that it is centered in the pipe.
    b. The camera shall have a cross-hair to maintain a constant reference on the image.
    c. The camera shall be equipped with sufficient lights to completely illuminate the interior of the pipe within the range of the camera.
4. A CD shall be made on the entire footage of pipe televised and delivered to the Owner. An alternative, upon written consent of the Engineer, to the CD is a video tape of the footage. The linear footage of pipe televised shall be integrated into the CD or video tape for ease of identification of pipe being viewed.

END OF SECTION