SECTION 7 - INSTALLATION

7.01 GENERAL

The following Section addresses the minimum requirements for the installation of sanitary sewers within Fall Creek Regional Waste District.

7.02 WORKMANSHIP

A. LINE AND GRADE

The contractor and/or engineer (Owner's representative) shall furnish and set all line and grade stakes (HUB) and stakes for bench marks. The bench marks shall be set in strategic locations of the project in order to facilitate the Contractor's installation of the line and grade stakes (HUB) for each pipeline. Only the line laser method is approved by the District. The contractor shall constantly check line and grade of the laser beam and the pipe.

B. INSTALLATION OF SANITARY SEWERS

Suitable tools and equipment shall be used for the safe and convenient handling and laying of pipe. Great care shall be taken to prevent pipe coatings or wrappings from being damaged. Carefully examine all pipe for cracks and other defects. No pipe or fittings shall be laid which are known to be defective. If pipe or fittings are discovered to be cracked, broken or defective after being laid, they shall be removed and replaced with sound material. Thoroughly clean all pipe and fittings before installation. All pipe and appurtenances should be kept clean until accepted as completed work.

C. POINT OF COMMENCEMENT AND DIRECTION OF LAYING

The point of commencement for laying of sewer pipe shall be the lowest point in the proposed sewer line. Lay the pipe with the bell end of bell and spigot pipe or with the receiving groove end of tongue and groove pipe pointing upgrade. Any other procedure shall be followed only with permission of the District.

Lay each pipe on an even firm bed as specified so that no uneven strain will come to any part of the pipe. Particular care shall be exercised to prevent the pipes from bearing on the sockets. Dig all bell holes for bell and spigot pipe.

Completely shove home all pipe (to the assembly mark). On pipe of the tongue and groove type thirty (30) inches and larger in diameter, pressure must be applied to the center of each pipe as it is laid by a winch and cable or other mechanical means.

All connection fittings shall be sealed with a watertight plug or stopper.

The contractor shall extend the building wye lateral to the Right-of-Way and shall place a one (1) inch cast iron locator rod or magnetic locator tape above the end of the pipe to within one (1) foot of the ground surface. The purpose is to provide for ease of location of the wye stub.

D. CONSTRUCTION BULKHEADS

Before extending a sanitary sewer, the Contractor shall provide a watertight plug in the existing sewer immediately downstream of the point of connection. This plug shall be left in place until the new sanitary sewer has been cleaned of all accumulated water and debris and accepted by the District.

During all intermissions in construction of the sanitary sewer pipe, the open face of the last pipe laid shall be plugged so as to prevent sand, water, earth or other materials from entering the pipe.

Whenever pipe and special castings are required to be cut, the cutting shall be done by skilled workmen in such a manner as to leave a smooth end at right angles to the axis of the pipe without damage to the pipe casting or cement lining. CUTTING TORCHES SHALL NOT BE USED.

E. LAYING OF PIPE IN COLD WEATHER

The District reserves the right to order pipe installation discontinued whenever, in our opinion, there is danger of the quality of work being impaired because of cold weather. The Contractor shall be responsible for heating the pipe and jointing material so as to prevent freezing of joints. Do not lay any pipe on frozen ground. No flexible or semi-rigid pipe shall be laid when the air temperature is less than 32 F unless proper precautions per the manufacturer's recommendations are taken by the Contractor and the method is approved by the Engineer and District.

When pipes with rubber gaskets or resilient-type joints are to be laid in cold weather, sufficiently warm the gasket or joint material so as to facilitate making a proper joint.

F. ABANDONED SEWERS

Sewers and storm water drains which are to be abandoned shall be bulkheaded with mortar and an eight (8) inch thick brick wall. Sewers, storm water drains, and sewer structures which are to be abandoned in place shall be filled with sand or Cellular Concrete and plugged, unless otherwise indicated on the Plans. Service shall be maintained in such sewers and drains until the District shall order bulkheads placed. No timber bulkheads shall be allowed. All castings on such abandoned structures are the property of the District and shall be salvaged by the Contractor and delivered as directed.

Unless otherwise specified, all abandoned manholes, catch basins and inlets shall be removed to a depth of three (3) feet below the proposed or established grade or existing street grade, whichever is lower.

7.03 DEWATERING AND CONTROL OF SURFACE WATER

Where groundwater is encountered, the Contractor shall make every effort necessary to secure a dry trench bottom before laying pipe. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose, piping, wellpoints, etc., necessary to depress and maintain the groundwater level below the base of the excavation. If the Contractor is unable to remove the standing water in the trench, the Contractor shall over-excavate the proposed bottom grade of the sewer bedding, and place not less than three (3) inches of Class No. 2 crushed stone (Indiana Department of Highway aggregate Classification) in the over-excavated area.

The Contractor and/or Developer shall be liable for all lawsuits which may arise as a result of the Contractor's dewatering efforts.

The Contractor shall keep the site free of surface water at all times and shall install drainage ditches, dikes, pumps, and perform other work necessary to divert or remove rainfall and other accumulation of surface water from excavations. The diversion and removal of surface and/or groundwater shall be performed in a manner which will prevent the accumulation of water within the construction area.

UNDER NO CIRCUMSTANCES SHALL SURFACE WATER AND/OR GROUNDWATER BE DISCHARGED TO, DISPOSED OF OR ALLOWED TO FLOW INTO THE DISTRICT'S SANITARY SEWER SYSTEM.

7.04 TRENCHING

The width of the trench at and below the top of the sanitary sewer shall be only as wide as is necessary for proper installation and backfilling, and consistent with safety requirements. The minimum width of trench for sanitary sewers, including force mains, 42-inches in diameter and less shall be 1.25 times the outside diameter (O.D.) plus 12-inches (See Figures 7-1, 7-2 and 7-3):

Minimum Trench Width (inches) - 1.25 (O.D.) + 12

The Minimum trench width for sanitary sewers larger than 42 inches in diameter shall be determined on a case-by-case basis by the Engineer and approved by the District.

The design plans and specifications submitted to the District for review, approval and issuance of a construction permit shall include a detailed trench drawing.

The design of the sewer pipe and structures is predicated upon the width of trench indicated above and, should these limits be exceeded, the Contractor shall be responsible for the provision and installation of such remedial measures as may be required by the Engineer and/or the District.

Bell holes shall be excavated for bell and spigot pipe and mechanical joint pipe, so that the entire barrel of the pipe shall rest on the bedding.

The pipe trench shall not be excavated more than one hundred (100) feet in advance of pipe laying.

Whenever pipe trenches are excavated below the designed bedding bottom, the Contractor shall fill the over-excavation with mechanically compacted No. 8 (1/4-inch to 3/4-inch) crushed stone or No. 8 fractured face aggregate.

All rock, boulders and stones 2-inches in diameter and larger encountered in trenches shall be removed. Boulders or rocks are not to be used for trench backfill.

In cases where material is deposited along open trenches, the material shall be placed so that no damage will result to the work or adjacent property as a result of rain or other surface wash.

If the bottom of the trench is of undesirable material, an additional six (6) inches of trench bottom shall be excavated and filled with Class 2 crushed stone and compacted using a hand held mechanical tamper. Where the distance to stable ground is excessive, the Engineer shall order in writing other types of foundation as he deems necessary subject to the approval of the District.

Remove any rock(s) encountered within six (6) inches below the barrel surface of the pipe, replace with No. 8 crushed stone or No. 8 fractured face aggregate and compact.

7.05 BEDDING AND BACKFILL - SANITARY SEWERS

The following Section provides the minimum requirements for the bedding of pipe and the backfilling of the trench.

Figures 7-1, 7-2 and 7-3 provides the bedding requirements for PVC, HDPE, and PVC Composite, Ductile Iron and Concrete, respectively.

Per Section 7.04 - Trenching, where the bottom of the trench is of undesirable material, an additional six (6) inches of trench bottom shall be excavated and a stable foundation shall be constructed using compacted No. 2 crushed stone.

All sanitary sewer pipe shall be laid to the lines and grade shown on the approved design plans unless otherwise approved by the District.

A. BEDDING - SANITARY SEWERS

Bedding material shall be compacted No. 8 crushed stone or No. 8 fractured face aggregate and shall be placed in the trench bottom such that after the pipe has been placed thereon, imbedded to grade and aligned, there remains a 4-inch minimum depth of material below the pipe barrel and a minimum of 3-inches below the bell.

The bell holes shall be excavated so that the entire pipe barrel rests on the bedding. The following presents the bedding requirements for each pipe classification:

1. Flexible pipe (Figure 7-1): PVC and HDPE Pipe

No. 8 crushed stone or No. 8 fractured face aggregate shall be placed around the sides of the pipe up to the springline (1/2 the Outside Diameter). This material shall be shovel sliced or otherwise carefully placed and "walked" or hand tamped in to ensure compaction of the haunch area and complete filling of all voids. From the springline to twelve (12) inches above the crown of the pipe, bedding shall be added in six (6) inch lifts "walked" in for compaction. Backfilling of the remainder of the trench shall be as specified in this Section.

2. Semi-Rigid Pipe (Figure 7-2): PVC Composite and Ductile Iron Pipe

No. 8 crushed stone or No. 8 fractured face aggregate shall be placed around the sides of the pipe up to the springline (1/2 the Outside Diameter). This material shall be shovel sliced or otherwise carefully placed and "walked" or hand tamped in to ensure compaction of the haunch area and complete filling of all voids.

From the springline to six (6) inches, or 1/2 the Outside Diameter above the top of the pipe, whichever is larger, bedding shall be added in six (6) inch lifts "walked" in for compaction. Backfilling of the remainder of the trench shall be as specified later in this Section.

3. Rigid Pipe (Figure 7-3): Concrete Pipe

No. 8 crushed stone or No. 8 fractured face aggregate shall be placed around the sides of the pipe up to the springline (1/2 the Outside Diameter). This material shall be shovel sliced or otherwise carefully placed and "walked" in or hand tamped to ensure compaction of the haunch area and complete filling of all voids.

From the springline, the trench shall be backfilled as specified in this Section.

B. BACKFILLING SANITARY SEWERS

1. Backfill Material The following materials shall be used to backfill the trenches in accordance with and in the manner indicated by the requirements specified herein:

Class I Angular, six (6) to forty (40) millimeters (1/4 to 1-1/2 inch) graded stone such as crushed stone.

Class II Course sands and gravels with maximum particle size forty (40) millimeters (1-1/2 inch), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW and SP are included in this class.

Class III Fine sand and clay gravels, including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil types GM GC, SM and SC are included in this class.

Class IV Silt, silty clays and clays, including organic clays and silts of medium to high plasticity and liquid limits. Soil types MH, ML,CH and CL are included in this class. These materials are not recommended for bedding.

Backfill Around Pipe (Bedding): Bedding and backfill materials shall be agreed upon prior to construction by the Engineer and Contractor. Samples will be obtained and kept at the Engineer's office. No deviation from this material will be permitted for use without authorization by the Engineer and the District.

The term "Select Fill" shall mean the use of Class II or III backfill materials as described above.

The trench shall be backfilled per the following:

2. Areas Subject to Vehicular Traffic

In areas under proposed or existing paved roads or within five feet of pavement, sidewalks, curbs, gutters or similar structures, granular backfill material complying with the requirements of the Indiana Department of Highways Standard Specifications, 1988 Edition, shall be used.

The material shall be placed in uniform layers not exceeding six (6) inches, loose measurement. Within three (3) feet of the sanitary sewer pipe the backfill material shall be thoroughly and uniformly compacted with hand held mechanical tampers. The remaining backfill material shall be compacted with mechanical tampers. A minimum compaction of 95 percent Standard Proctor Density shall be achieved within the backfill material.

Jetting or flooding of the backfill or other alternative compaction methods and materials shall NOT be used without the approval of the District and other jurisdictional authority.

3. Areas NOT Subject to Vehicular Traffic

In areas five (5) feet or more from the paved surfaces provided in 7.05 B.1., the trench shall be carefully backfilled with clean fill material free of rocks larger than 2-inches in diameter, frozen lumps of soil, wood or other extraneous material.

7.06 TRENCH BOX PULLING AND SHEETING

When required by the Occupational Safety and Health Act (OSHA) to protect life, property, or the work, sheet and brace all open cut trenches in accordance with CFR 1926. Upon completion of the work, all temporary forms, shores, and bracing shall be removed. All vacancies or voids left by the sheeting, while being withdrawn, shall be carefully filled with bedding material.

The Contractor shall employ adequate safeguards to prevent movement of the pipe joint. If any movement should occur, the Contractor shall reinstall the pipe.

Any damage to pavement or other structures due to sheeting, shoring, or bracing shall be repaired by the Contractor at his own expense.

Sheeting and bracing which is to remain in place shall be cut off at the elevation of 1.5 feet above the top of the sewer pipe.

7.07 SANITARY SEWER MANHOLES INSTALLATION

Section 5.04 provides information regarding the design of manholes.

A. PREPARATION OF BASE

The bottom of the excavation/trench for the manhole shall be filled with a minimum of six (6) inches of No. 2 crushed stone mechanically compacted to form a stable base. Where poor or unstable soil conditions exist or over excavation has occurred, additional No. 2 crushed stone or Class B concrete shall be used to form a stable base.

B. PLACEMENT OF MANHOLE SECTIONS

Precast manhole sections shall be placed and aligned to provide vertical sides. The completed manhole shall be rigid, true to dimensions and watertight.

Per Section 5.04, the joints between manhole sections shall be made with an approved rubber o-ring in accordance with ASTM C-443 and a 1/2 inch diameter non-asphaltic mastic (Kent Seal or equal) conforming to AASHTO M-198 and Federal Specifications SS-521-A.

C. PIPE CONNECTIONS TO MANHOLES

Connections to new or existing manholes shall be per Section 5.04-M. Connections to existing manholes shall require the installation of flow channels and bench walls per Section 5.04-E.

Where the Contractor connects to an existing manhole, that manhole shall be rehabilitated to current standards of the District. This requirement shall include rehabilitating flow channel, as well as prescribed measures to eliminate infiltration and inflow to required levels.

D. BACKFILLING OF MANHOLES

Manhole backfilling and compaction shall comply with the requirements as specified for the adjacent sanitary sewer.

E. PLACEMENT OF ADJUSTING RINGS

Per Section 5.04-F, seal all joints; 1) between the casting and adjusting ring/chimney, 2) between adjusting rings with one (1) one half (1/2) inch diameter cord of extrudable preformed gasket material, and 3) between the adjusting rings and precast cone section with a minimum of two (2) one half (1/2) inch diameter cords of extrudable preformed gasket material. Between adjusting rings, the extrudable gasket material shall be placed in the keyways and be of sufficient quantity to completely fill the joint cavity.

F. MANHOLE WATERPROOFING - EXTERIOR

Per Section 5.04-I, the exterior of the manhole from two (2) inches below the bottom of the adjusting rings on the cone to and covering the base of the casting, including the adjusting rings, shall be coated and the voids shall be filled with a trowellable grade butyl rubber base backplaster material.

G. CONNECTION FOR FUTURE SEWERS

All sewer structures shall be designed based on the future estimated growth (see Section 4). In areas where future residential or industrial growth can occur, manholes over fifteen (15) feet in depth shall be equipped with up to two (2) outside drop connections installed per Section 4. Future or unused connection pipes shall be plugged with a watertight stopper.

H. OUTSIDE DROP MANHOLES

See Section 5.04-J for details.

7.08 INSTALLATION OF BUILDING SEWERS (LATERALS)

A connection permit issued by the District shall be obtained prior to the installation of a building sewer.

Per Section 5, only PVC SDR 35. wall bell and spigot type pipe shall be used.

All building sewers shall have a cleanout located within three (3) feet of the exterior building wall and shall be installed per Figure 7-4 or 7-5. Also, if building sewer is more than 100' in length, add a cleanout for over 100'.

Connections to new sanitary sewers shall only be made at the manufactured fitting. No saddle connections shall be allowed if a manufactured fitting exists based upon approved as-built plans.

The point of commencement for laying of the building sewer pipe shall be at the connection to the main sewer and shall be laid with the bell end pointing upgrade.

Bedding per the specification of PVC flexible pipe shall be required.

Connections to sanitary manholes shall not be made without the written approval of the District. Building sewers shall connect to the manhole, when approved, at an elevation of not more than 24 inches above the base of the manhole. No inside drop connections shall be allowed without written approval of the District.

END OF SECTION 7

SECTION 9 - INSPECTION, TESTING AND ACCEPTANCE

9.01 GENERAL

The following section describes the minimum requirements and general procedures for the inspection and testing of sanitary sewer systems to be dedicated to the District.

The sanitary sewer system shall not be accepted nor will connection permits be issued until all requirements for inspection and testing, including filing of affidavits and any other paperwork are completed.

Any section of sanitary sewer not passing the tests prescribed herein shall be repaired to the satisfaction and approval of the District, retested and reinspected via closed circuit televising.

9.02 INSPECTION

Inspection of the sanitary sewer system shall occur throughout the construction of the collector sewer system and upon the installation but prior to the backfilling of the building sewer (lateral) as part of the Sanitary Sewer Construction Permit and Connection Permit programs, respectively.

A. SANITARY SEWER CONSTRUCTION INSPECTION

1. General

As previously discussed, prior to the issuance of a Construction Permit and the commencement of construction of a sanitary sewer system, the Owner shall make arrangements with the District for Construction Observation Services to be provided.

2. Estimated Cost

Where a lift station is involved, additional time for the inspection during construction and final checkout of the inspection during construction and final checkout of the lift station shall be added. Estimates for inspection costs can be obtained by contacting the District.

The above is a pre-construction estimate only. The actual Observation time will vary from project to project and may exceed or be less than this estimate based upon actual project duration. Observation time at the site is verified by the Contractor and/or a representative of the Owner.

3. General Requirements

a. Contractor and/or Owner shall provide notice to the District of the planned commencement of construction forty-eight (48) hours prior to such commencement.

b. Once the construction starts, the Contractor shall be responsible for informing and/or notifying the Observer assigned of the following:

(1) Daily work schedule including any changes in schedule,

(2) Prior notification if work is to be performed on weekends and/or holidays,
(3) Date air and mandrel tests are to be performed, and
(4) Date as-built verification is to be performed.

c. The District, upon request of the contractor and/or Owner, will schedule the Final Inspection. All testing required shall be performed under the observation of the District observer. It shall be the Contractor's responsibility to schedule the testing with the Observer and/or District. Test results obtained in the absence of the presence of the District's Observer will not be accepted.

B. CONNECTION PERMIT - BUILDING SEWER INSPECTION

As discussed in Section 3, a sewer Connection Permit shall be obtained for any repair, modification or connection of a building sewer to a public sewer. Connection permits shall not be issued for connection to sanitary sewers not yet dedicated to and accepted by the District.

Following the installation/repair/modification and prior to the backfilling of the Building Sewer, the Contractor/Plumber shall notify the District that the Building Sewer is ready to be inspected. The District shall then have four (4) hours to make the inspection after which the Contractor/Plumber may backfill the trench. The notification of the District shall adhere to the requirements of Fall Creek Regional Waste District.
If notification is not provided and the building sewer is backfilled prior to inspection, at the District's request the Contractor/Plumber shall be required to re-excavate the trench so that an inspection can be made.

9.03 TESTING (GRAVITY SANITARY SEWERS)

Once constructed, all sanitary sewers and manholes shall be watertight and free from leakage. The Contractor shall be required to repair all visible leaks to the satisfaction of the District. Any leakage found during the infiltration test shall be corrected by the Contractor at his expense.

The method of repair shall be per the approval of the District; however, grouting of the joint or crack to repair the leakage shall not be permitted. If the defective portion of the sanitary sewer cannot be located, the Contractor will remove and reconstruct as much of the work as is necessary to obtain a system that passes infiltration requirements.

All gravity sanitary sewers constructed of flexible pipe (PVC and HPDE) and Truss pipe shall be mandrel tested no sooner than thirty (30) days after installation per the requirements herein.

The Contractor shall bear the complete cost and supply all equipment necessary to perform the tests required.

All tests shall be conducted under the observation of the District's Inspector. It shall be the Contractor's responsibility to schedule testing with the Inspector.

A. LOW PRESSURE AIR TEST (GRAVITY SEWERS)

All gravity sanitary sewers shall be tested for infiltration by means of a low pressure air test as generally described herein. Any other infiltration test procedure will only be

allowed following the submittal of the procedure to the District for review and upon written approval by the District.

1. Equipment

The Contractor shall be responsible for providing all equipment and supplies necessary for the performance of a Low Pressure Air Test including but not limited to the following:

a. Mechanical or pneumatic plugs;

b. Air control panel;

c. Shut-off valve, pressure regulative valve, pressure relief valve and input pressure gauge. The pressure regulator or relief valve set shall be set no higher than 10 psig to avoid over pressurization; and

d. Continuous monitoring pressure gauge having a range of 0 to at least 10 psi. The gauge shall be no less than 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of +/- .04 psi.

To reduce the potential for sewer line over-pressurization, two (2) separate hoses shall be used to: (1) connect the control panel to the sealed line for introducing low pressure air, and (2) a separate hose connection for constant monitoring of air pressure buildup in the line.

If pneumatic plugs are utilized, a separate hose shall be required to inflate the pneumatic plugs.

2. Ground Water Elevation and Air Pressure Adjustment

a. General

Per Section 5.04; a few key manholes shall have a one-half inch diameter threaded pipe nipple installed through the manhole wall directly on top of one of the sanitary sewers entering the manholes as shown in Figure 9-1. Every manhole need not have a pipe nipple installed. The design Engineer shall designate the manholes to be used for gauging the ground water level. The pipe nipples shall be sealed with a threaded one-half inch cap.

Immediately before air testing, the ground water level shall be determined by removing the threaded cap(s) from the nipple(s) nearest the section to be tested blowing air through the pipe nipple(s) to remove any obstructions, and then connecting clear plastic tube(s) to the pipe nipple(s). Each plastic tube shall be held vertically to allow groundwater to rise in it. After the water level in the tube has stopped rising, a measurement of the height in feet of water over the invert of the sewer pipe shall be taken per Figure 9-1. If the section to be tested is not immediately adjacent to an installed pipe nipple, the groundwater height shall be estimated based upon nearby height readings and the pipe's invert elevation. Alternate ground water monitoring methods shall require the prior written approval of the District.

b. Air Pressure Adjustment

The air pressure correction, which must be added to the 3.5 psig normal test starting pressure, shall be calculated by dividing the average vertical height, in feet of groundwater above the invert of the sewer pipe to be tested, by 2.31. The result gives the air pressure correction in pounds per square inch to be added. (for example, if the average vertical height of groundwater above the pipe invert is 2.8 feet, the additional air pressure required would equal 2.8 divided by 2.31 or 1.2 psig. This would require a minimum starting pressure of 3.5 plus 1.2 or 4.7 psig.)

c. Maximum Test pressure

In no case should the starting test pressure exceed 9.0 psig. If the average vertical height of groundwater above the pipe invert is more than 12.7 feet, the section so submerged may be tested using 9.0 psig as the starting test pressure. The 9 psig limit is intended to further ensure workman safety and falls within the range of the pressure monitoring gauges normally used.

3. Test Procedure

Following are general procedures to be employed in the performance of the test. Figure 9.2 is a recommended Air Test Data Sheet for use in recording the test. Other test data sheets may be allowed based upon approval by the District. These test data sheets shall be submitted to the District.

a. Plug Installation and Testing

After a segment of pipe has been backfilled to final grade, prepared for testing, and the specified waiting period has elapsed, the plugs shall be securely placed in the line at the ends of each segment to be tested.

It is advisable to plug the upstream end of the line first to prevent any upstream water from collecting in the test line. This is particularly important in high groundwater situations.

When plugs are being placed, the pipe adjacent to the manhole shall be visually inspected to detect any evidence of shear in the pipe due to differential settlement between the pipe and the manhole. A probable point of leakage is at the junction of the manhole and the pipe. This fault may be covered by the pipe plug, and thus not revealed by the air test.

b. Line Pressurization

Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any groundwater above the pipe, but not greater than 9.0 psig. If groundwater is present, refer to Section 9.03 A.2. Ground Water Elevation and Air Pressure Adjustment to determine the internal pressure to be applied.

c. Pressure Stabilization

After a constant pressure of 4.0 psig (greater than the average groundwater back pressure) is reached, the air supply shall be throttled to maintain) that internal pressure for at least 2 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

d. Timing Pressure Test

When temperatures have been equalized and the pressure stabilized at 4.0 psig (greater than the average groundwater back pressure), the air hose from the control panel to the air supply shall be shut off or disconnected.

The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig (greater than the average back pressure of any groundwater over the pipe). At a reading of 3.5 psig, or any convenient observed pressure reading between 3.5 psig and 4.0 psig (greater than the average groundwater back pressure), timing shall commence with a stop watch or other timing device that is at least 99.8% accurate.

e. Determination of Line Acceptance

If no pressure drop is observed, the section undergoing test shall have passed and shall be presumed to be free of air leaks. The test may be discontinued once the prescribed time has elapsed.

f. Determination of Line failure

If the pressure drops before the appropriate time has elapsed, the air loss rate shall be considered excessive and the section of pipe shall be determined to have failed the test.

4. Test Times

a. Testing Main Sewers with Building Sewers

In general, the District will only approve the construction of the main line sewer and wye connections with the lateral stubbed-off to the property line. Building sewers will be allowed to be installed during the construction of the main line sewer only upon the written request to and written approval of the District. This shall be clearly delineated on the design plans and specifications submitted for approval by the District.

If building sewers are approved for construction by the District as part of the mainline sewer they shall be included in the test.

b. Specified Time Tables

The Contractor is responsible for the repair of any section of pipe which fails the air test. Repaired sections of pipe must be retested and pass the air test prior to being accepted by the District. No grout repair will be allowed.

B. MANDREL TEST FOR SELECT PIPE

A five (5) percent "GO-NO-GO" Mandrel Detection Test shall be performed on all PVC, HDPE and PVC Composite gravity sanitary sewer pipe.

These pipes shall be mandrel with a rigid device sized to pass five percent (5%) or less deflection (or deformation) of the base inside diameter of the pipe.

The mandrel test shall be conducted no earlier than thirty (30) days after reaching final trench backfill grade, provided that in the opinion of the District sufficient water densification or rainfall has occurred to thoroughly settle the soil throughout the entire trench depth. If densification, in the opinion of the District, has not been achieved within the thirty (30) day time frame, the mandrel size shall be increased to measure a deflection limit of three percent (3%).

The mandrel (GO-NO-GO) device shall be cylindrical in shape and constructed with nine (9) or ten (10) evenly spaced arms or prongs. Mandrels with less arms shall not be allowed due to being insufficiently accurate. The mandrel diameter dimension "D" shall be equal to the inside diameter of the sanitary sewer.

Allowances for pipe wall thickness tolerances or validity (from heat, shipping, poor production, etc.) shall not be deducted from the "D" dimension but shall be counted as part of the 5% or lesser deflection allowance. As an example, the dimensions for the mandrel shown in Figure 9.3 for ASTM D-3034 PVC pipe shall be as listed in Table 9.2. Each pipe material/type required to be Mandrel tested shall be tested with a mandrel approved by the pipe manufacturer and meeting the requirements of this Section. The "D" mandrel dimension shall carry a tolerance of +/- 0.01 inches.

The mandrel shall be hand pulled through all sewer lines and any section of sewer not passing the mandrel shall be uncovered, replaced or repaired to the District's satisfaction and retested.

The contact length (L) shall be measured between points of contact on the mandrel arm. The length shall not be less than as shown in Table 9.2.

The Contractor shall provide proving rings to check the mandrel. Drawings of mandrels with complete dimensions shall be furnished by the Contractor to the District upon request for each diameter and specification of pipe.

C. MANHOLE TESTING

Each manhole shall be visually inspected after assembly and backfilling by the District's Inspector for leakage or evidence thereof.

If the manhole shows leakage or signs thereof, the manhole shall be repaired to the satisfaction of the District and reinspected, and vacuum tested.

All manholes are to be checked by the District Inspector 30 days after installation and again before the one (1) year warranty period ends. If they show signs of leakage, they shall be vacuum tested by an approved company and repaired at the Contractor's or Developer's expense. By no means will any leakage be allowed.

D. VACUUM TEST PROCEDURES

Standard Test Method for Concrete Sewer Manholes by the Negative Air pressure (Vacuum) Test.

This standard is issued under the fixed designation C 1244; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number of parentheses indicates the year of last reapproval. A superscript epsilon (e) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers procedures for testing precast concrete manhole sections when using the vacuum test method to demonstrate the integrity of the installed materials and the construction procedures. This test method is used for testing concrete manhole sections utilizing mortar, mastic, or gasketed joints.

1.2 This test method is intended to be used as a preliminary test to enable the installer to demonstrate the condition of the concrete manholes prior to backfill. it may also be used to test manholes after backfilling; however, testing should be correlated with the connector supplier.

1.3 This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.4 This test method is the companion to metric Test Method C 1244M; therefore, no SI equivalents are shown in this test method.

NOTE 1 - Vacuum test criteria presented in this test method are similar to those in general use. The test and criteria have been widely and successfully used in testing manholes.

NOTE 2 - It should be understood that no correlation has been found between vacuum (air) and hydrostatic tests.

2. Reference Documents

2.1 ASTM Standards:

C822 Terminology Relating to Concrete Pipe and Related Products/2

C924 Practice for Testing Concrete Pipe Sewer Lines by Low-pressure Air Test Method/2

C969 Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines/2

3. Terminology

3.1 For definitions of terms relating to manholes, see Terminology C822.

(1) This practice is under the jurisdiction of ASTM C-13 on Concrete Pipe and is the direct responsibility of Subcommittee

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DRAWN BY SMD	JOB NUMBER 2017-271-A
CHECKED BY SMD	
DATE NOVEMBER 8, 2018	
SCALE N/A	
SHEET C8.8 SANITARY SPECIFICATIONS	

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