SECTION 335100 - SANITARY SEWER COLLECTION SYSTEM MATERIALS

ALL LIBRARIES

PART 1 - GENERAL

Materials for use at any location in the Sanitary Sewer system (extensions or existing) shall meet the requirements as set forth in the following Articles under this Section, or as noted and/or detailed on the project plans.

PART 2 – PIPE, PIPE JOINTS AND FITTINGS

2.1 GRAVITY SEWER

A. Rigid Plastic Pipe, Joints and Fittings: Pipe for use under this heading shall be of the bell and spigot type. All pipe and materials shall be made from P.V.C. components in accordance with A.S.T.M. specification D1784 for rigid polyvinyl chloride compounds. The pipe bell shall be an integral part of the pipe barrel. The spigot end of each pipe length shall be beveled to permit making up the joint. All pipe spigot ends shall be marked to show full make-up joint depth. All pipe shall meet or exceed the strength requirements when tested in accordance with A.S.T.M. specification D3034.

1. Pipe Joint: All pipe shall be joined by means of a rubber ring slip joint. Cement weld or glued joints will not be permitted. The slip joint shall be formed by a bell joint. The bell joint where used, shall be an integral and homogenous part of the pipe formed by extrusion, with a ring groove for seating the rubber ring gasket. The rubber ring gasket shall be partially split or perforated to permit expansion and contraction with respective increased or decreased pressure in the main.

2. Pipe Fittings: Lateral service line connected to the sewer main shall be made with wye type fittings inserted in the sewer main piping. Service laterals shall be installed as shown on the plans, or as directed. Each service lateral or wye shall terminate with a rubber faced expander plug to fully seal the open pipe end until same is required for service. Pipe fitting materials shall be the same as that specified for the piping materials. All fitting joints shall be sealed using rubber ring gaskets as previously specified.

All gravity sanitary sewer main and lateral service lines shall be SDR 35 and shall be supplied in 13 feet (minimum) lengths.

PART 3 - MANHOLES

3.1 MANHOLES

A. Pre-Cast Manholes: Pre-cast manhole straight sections with eccentric top or cone sections may be used for manhole construction. Bottom sections, with properly located inlet and invert openings sized for sewer main as required, may be used. As will be noted from the plant profile segments, most manholes are designed for two tenths (0.2) foot of fall across the

manhole. All manhole sections shall be fitted with, or provided with rubber coated manhole steps. Concrete for all pre-cast manhole sections shall be designed of ingredients that will produce a minimum 3,500 psi. compressive strength at 28 days. All sections shall be fully reinforced with welded wire fabric.

B. Manhole Frames and Covers: Shall be of the type and duty as shown on the manhole plans. Iron castings shall conform to the latest revisions of ASTM and specification A-48, Class 20. All castings for use shall be true to pattern in form and dimensions, free from faults, sponginess, cracks, blowholes, and other defects. The bearing surfaces, between frames and covers, shall be machined, fitted together, and match marked, to prevent rocking.

PART 4 – PIPE BEDDING

4.1 Materials to be used for this purpose shall consist of fine, clean, durable particles of crushed stone. Crushed stone used for this purpose shall consist of materials passing a 1-inch sieve to dust or as noted on the construction drawings.

PART 7 – CONNECTION TO PRESENT SYSTEM

7.1 MATERIALS

A. Materials to be used for connections to the present system shall be in accordance with the preceding Articles as applicable, under this Section of these specifications. Installation and testing of all items shall be in strict accordance with the following Section of these specifications. Under all circumstances, extreme care must be exercised when connecting to the present system. Foreign materials of whatever nature, must not be permitted to enter the system.

B. The Contractor shall notify the Owner prior to connection so that proper notification to those affected may be provided. Where system segment shut-down is required, the actual shut-down is not to be done until all connection materials, equipment, and personnel are at the site, and the existing system point of connection has been exposed, thoroughly cleaned, and prepared for immediate installation of the connection materials. All personnel shall be thoroughly instructed as to the procedure to be followed and ready for work. All connections are then to be made in an efficient manner requiring the least amount of time and maximum amount of care.

C. Existing manholes shall be core bored or provided with a smooth cut for connection of new mains or services. The pipe to base connection shall be made using a rubber gasket around the pipe barrel with sufficient flap to act as a water stop when sealed in the socket or hole filler grout. An asphaltic-fibre cement shall be used over the joint connection around the full pipe diameter, after the filler grout has hardened. Concrete for additional support of the connecting sewer main, shall be placed under the piping adjacent to the manhole base.

PART 9 – CONCRETE FOR PIPE ENCASEMENT AND/OR SUPPORT

Concrete to be used for pipe encasement and support shall consist of ingredients designed to produce a mixture having a 3,500 psi., compressive strength at 28 days curing time. The mix shall be as "dry" as possible using only sufficient water to permit mixing and placement. Excessive water will not be permitted. Cement for use shall be the "high early" type to provide initial set as soon as possible. Concrete may be placed and covered with earth fill to prevent freezing during periods of cold weather. However, frozen ingredients will not be permitted for use. All concrete used and placed for this purpose shall be given at least three (3) days curing time before being placed under stress.

SANITARY SEWER COLLECTION SYSTEM INSTALLATION

PART 1 – GENERAL

1.1 Underground pipe construction shall be in accordance with the recommended practice as outlined by the pipe manufacturer.

1.2 All excavations shall be made to such depths and widths as will give ample room for building all structures, sewers, and appurtenances as detailed on the approved plans.

1.3 Clearing and grubbing the site of work, excavation of earth or other materials, sheeting and bracing, pumping and drainage, backfilling, rough grading, and cleaning up shall all be done as specified. In addition, all work maintaining or replacing existing fences, roadways, drives, lawns or structures disturbed by the work, safety precautions and other miscellaneous general work not specified under specific items is to be included in the work done under this section.

PART 2 - SITE AND WORK PREPARATION

2.1 Prior to starting the various installations, connections, and/or changes as required the contractor shall notify the Owner a minimum of twenty-four (24) hours prior to the start of construction. After so doing, the Contractor shall clear the route of all trees, shrubs, and other objects or materials which may directly interfere with the construction. All other utility companies or organizations shall be notified for location of their respective facilities prior to starting any work. All trees, shrubs, bushes, etc., which will not interfere with the construction shall be protected from damage. Work preparations shall include having all necessary material items, equipment, and an adequate labor force at the site in working condition, and completely instructed and prepared to perform the work to completion as required.

PAR 3 - DRAINAGE

3.1 The Contractor shall control the grading in the vicinity of the pipe trenches so that the surface of the ground will be properly sloped to prevent water from running into the excavated areas. Any water or other liquid wastes which accumulate in the excavated areas shall be promptly removed.

PART 4 - TRENCH EXCAVATION

4.1 Contractor shall perform all excavation necessary for or incidental to the proper installation and construction of the work shown and detailed on the drawings, or as directed by the Engineer. Excavation shall include the removal of trees, shrubs, paving, and undesirable materials. Excavation shall be done along the lines as staked, and indicated on the plans and shall be continuous without improper bends or kinks. Trenches shall be of sufficient width to provide a working space on each side of the materials being installed. During excavation, materials to be used for backfill shall be stock piled, in an orderly manner, a sufficient distance from the edge of the excavation to avoid overloading which might cause slides of cave-ins, and in such manner so as not to interfere with public travel whenever possible. The contractor shall provide all barricades, lights, temporary crossing, warning signs, etc., that may be necessary to protect the public and the work from injury or damage.

4.2 Trenches for sewer main and appurtenances shall be excavated to a sufficient depth to obtain a minimum of thirty-six (36) inches of cover over the top of the pipe, except as otherwise required to make taps and connections to existing mains. All excavation shall be made so as to provide a

continuous bearing for the barrel of the pipe. Holes of sufficient size shall be excavated to permit ample room for making joints. The bottom of trenches shall be free from rocks, clods, debris, and all other unsuitable materials, and shall consist of properly shaped earth, or tamped granular material as specified in the previous Section of the specifications. The Contractor shall take care not to excavate below grade except to remove undesirable material, or as directed by the Engineer.

4.3 Where rock is encountered in the trenching operation, the excavation shall be carried to a depth of four (4) inches below the pipe bottom depth assuming proper cover as specified under the preceding paragraph. Where solid rock is encountered and it is necessary to drill and blast same, the Contractor shall provide all suitable equipment and personnel for carrying out the operation in a safe and sensible manner. The Contractor's Insurance shall include specific coverage for this and directly or indirectly related items.

4.4 When encountered, the Contractor shall strip from the solid rock areas all overlying earth in sections and shall then notify the Engineer for inspection and measurement. The Engineer may then take levels on the surface of the rock and adjacent ground level, or he may at his discretion, defer the measurement until after excavation is completed. In any event, the Contractor shall not refill any trench where rock is encountered until told to do so by the Engineer or his agent. The rock volume, using lengths and depths as measured in the field, shall be determined on the basis of using a two (2) foot trench width. The Contractor will not be allowed payment for any rock claimed unless same has been measured as herein provided.'

4.5 Excess materials resulting from the rock excavations shall be spread over or adjacent to the trench area where acceptable, or shall be picked up and removed from the site for disposal at a suitable location. It may also be necessary to place a thin layer of earth over the rock backfill areas. This may be hauled in from a stockpile location. This earth layer must be of sufficient depth to support the growth of vegetation. All loose rock and debris shall be thoroughly cleaned up and disposed of. The excavated areas shall be left in a neat, clean, acceptable condition.

PART 5 - HANDLING OF MATERIALS

5.1 All pipe, fittings, valves, manholes and other accessories, shall be unloaded, stored rehandled, and installed by methods and in such a manner as to insure their final location in a sound and undamaged condition, conforming in all respects to specified requirements. Under no circumstances shall pipe, fittings, valves, manholes, or other accessories, be dropped to the ground, or otherwise subjected to possible damage from impact or shock. Such materials shall be loaded by lifting with machine or hoist, or by skidding,. Pipe handled on skidways shall not be skidded or rolled against other pipe. When pipe line materials at the site of the work, each piece shall be unloaded opposite, or as close as possible to the point of installation in order to avoid unnecessary rehandling.

5.2 Under all circumstances, all materials for use shall be handled in a workman-like manner, using the necessary manpower and equipment to perform the task in accordance with the manufacturer's recommendations.

A. Protection of Materials, Coatings, and/or Linings: All materials shall be handled in such manner that neither the coatings or the linings will be damaged. Hooks for insertion into the ends of the pipes, fittings, valves, manholes, and other accessories, shall have broad, well-padded contact surfaces, and shall be of such design and size that uniform support will be

provided. Under most circumstances, damage to outside coatings are repairable, and the necessary repairs shall be properly made prior to installation. Damage to interior linings are not considered repairable, and therefore, the damaged item shall be replaced at the Contractors expense.

B. Handling Materials Into Trench: Proper equipment, tools, facilities, and methods satisfactory to the Engineer, shall be provided and used by the Contractor for the safe handling of all materials. Fittings, valves, and other accessories shall be carefully lowered into the trench or excavation, piece to protect coatings and linings. Under no circumstances shall any materials be dropped or dumped into the trench.

PART 6 - PIPE LAYING AND TRENCH BACKFILL

6.1 GENERAL

A. Installation shall start at the downstream end of the project and shall proceed upstream. All pipe spigot ends shall face downstream and bell ends shall face upstream. Laying of the pipe shall commence immediately after the excavation is started, and the Contractor shall use every possible means to keep the completed pipe installation closely behind the trenching. The Engineer may stop the trenching when in his opinion, the trench is open too far in advance of the pipe laying operation. The Contractor may lay pipe in the best manner adapted to securing speed and good results.

6.2 PIPE JOINTS

A. The Contractor shall have the necessary equipment and tools available for making the joints for the specific materials being used. In accordance with applicable items under the previous Section of these specifications, acceptable joints for the various pipe line and fitting materials are listed as follows:

1. P.V.C. Pipe: Ring title joint with necessary transition gaskets for connection to mechanical joint fittings, valves, and adapters.

   a. Pipe Joint Adapters: The Contractor shall provide the necessary adapters for all connection changes from ring-title, slip, or mechanical joint to flanged joint as and where required.

All pipe spigot ends shall be visibly marked to fully “make-up” the joint. With exception of field cut pipe, all “make-up” marks shall be placed on the pipe at the factory. Field cut pipe shall be marked for full joint depth prior to insertion.

6.3 PIPE CUTTING

A. Cutting of pipe for closure pieces with installation of valves or fittings, or for any other reason, shall be done in a neat and workman-like manner without damage to the pipe or linings. The cutting operation shall leave a smooth cut end at right angles to the longitudinal axis of the pipe. The exterior surface of the cut end shall be beveled, and the interior surface shall be reamed or filed free of all rough edges and protrusions. All pipe cutting shall be done by saw or mechanical pipe cutters of an approved type. Upon completion of the cutting and trimming operation, the

pipe end or ends shall be marked for "make-up" depth. Prior to insertion, the pipe shall be thoroughly cleaned of all foreign materials, including filing and cutting debris.

6.4 PIPE ALIGNMENT

A. Pipe lines intended to be straight shall be laid straight. Deflections from a straight line shall not exceed the manufacturers recommendations for joint deflections. Should the planned or specified alignment require deflections in excess of the maximum recommended for the type of pipe being installed, when using a standard pipe length within the limits of available space, then either shorter pipe sections, or additional bends shall be installed.

6.5 EXISTING UTILITIES

A. Existing utilities shall be protected during the construction period. Where necessary, the existing utility shall be removed or temporarily relocated, and replaced upon completion of that phase of the work creating this requirement. Under all circumstances, the utility involved and the parties being affected by the disrupted service shall be notified in advance of the proposed operation. All changes and work shall be subject to the approval and acceptance of the utility involved and the Engineer.

6.6 QUALITY

A. Damaged or unsound pipe, fittings, and accessories of whatever nature shall be rejected and removed from the work. All joints shall be made as previously specified. Each piece of pipe and all fittings, valves, etc., shall be checked and cleared of debris prior to being put in place. All gaskets shall be rechecked for operation and bolt tightness prior to installation. All open ends of pipe, fittings, etc., shall be carefully plugged or sealed at the end of each days work to prevent entrance of animals, water, and other foreign matter. All excavation shall be made to neat line and grade.

   All personnel involved in any way with the work must be made aware of the fact that the work shall result in a first-class, professional job.

6.7 TRENCH BACKFILL

A. After placing the piping in the trench, the Contractor shall backfill under and around the pipe simultaneously filling and tamping on both sides with sufficient earth to firmly hold the pipe in position. Extreme care must be exercised with the backfill operations to insure that no sizable stones or rocks come into contact with the pipe surfaces. After carefully placing and tamping the initial backfill in place to at least six (6) inches over the top of the pipe barrel, the remaining materials may be pushed into the trench. No boulders, broken pavement, or large pieces of blasted rock shall be used in the trench backfill. Any trench improperly bedded or backfilled shall be excavated, examined, and replaced at the Contractor's expense. All non-usable materials shall be picked up and removed form the site to an acceptable disposal location. Upon completion of the initial backfill, the backfill surface shall be neatly mounded to allow for settlement. As the work progresses and settlement occurs, the trenching surface shall continue to be graded and shaped so as to secure a final condition where no further settlement shall occur.
B. In areas where pavement or permanent surfacing is removed and is to be replaced, the entire backfill shall be made using fine crushed stone placed in six (6) inch layers and compacted to a maximum density.

C. Initial clean-up, in accordance with Article 14 shall occur as the trench backfill operation proceeds. Before final acceptance of the work is made, the Contractor shall travel the lines with the Engineer, and any settlement or unsightly areas shall be repaired or corrected as directed. Upon acceptance, the Contractor shall proceed with the final clean-up, grading, and seeding operation, in accordance with Article 15 this Section of the specifications.

PART 7 – SERVICE LINE WYE INSTALLATION

The Contractor shall furnish all materials and install service connection fittings and service lines as required.

A. Sewer Main Service Line Connection Fittings: Fittings for service line connection to the sanitary sewer main shall be placed where indicated in the field by the Engineer. All service connection fittings shall be wye or double wye fittings in accordance with Article 2 of Section III of the specifications. All service connection fitting joints shall be watertight and of a quality equal to that of the sanitary main being used.

B. Sewer Lateral Service Line: The Contractor shall furnish all materials and install sewer lateral service lines from connection to the sewer main wye fitting as shown on the plans.

All service lines and wye installed for future connections shall terminate with a rubber faced threaded compression type expanded plug. All service line and fittings shall be in accordance with Article 2 of Section III of the specifications.

PART 8 – MANHOLE INSTALLATION

8.1 BASE

A. Pre-cast manhole base sections shall be set on the prepared sub-grade in proper alignment for connection to the inlet and discharge connections. In the event fill under the base section is required to achieve the proper grade, it shall be made using a 1 inch minus crushed stone fill, fully compacted to sub-grade. Earth fill under pre-cast base sections will not be permitted.

1. Pipe Connections: Sewer main connections to the manhole base shall be made prior to placement of the manhole barrel sections. The pipe to base connection shall be made using a rubber gasket around the pipe barrel with sufficient flap to act as a water stop when sealed in the socket or hole filler grout. An asphaltic-fibre cement shall be used over the joint connection around the full pipe diameter, after the filler grout has hardened. Concrete for additional support of the connecting sewer main, shall be placed under the piping adjacent to the manhole base.

8.2 BARREL

A. The manhole barrel shall be set on the pre-cast base. The barrel shall be constructed of pre-cast sections as previously specified.

1. Pre-Cast Sections: The barrel to base joint shall be sealed using the rubber ring provided for this purpose when placing same over a pre-cast base section. The remaining seam shall be sealed using an asphaltic-fibre cement on the interior and exterior joint locations. All

remaining barrel joints and top or cone to barrel joint connection, shall be sealed using the rubber gasket and asphaltic-fibre cement application.
The entire exterior of the manhole shall be coated with asphaltic-fibre cement to achieve a water-tight seal.

An eccentric pre-cast top or cone section shall be placed over the manhole barrel sections. The top to barrel joint seal shall be made as previously specified for pre-cast section joints. All manhole steps shall be in alignment with the vertical wall of the manhole. The top of the cone section shall provide a 24-inch diameter circular opening.

8.3 MANHOLE COMPLETION

A. Upon completion of the manhole barrel construction, all debris shall be removed from the excavated area and disposed of. Following clean up; the excavated area shall be backfilled with clean earth. Care must be exercised to maintain the manhole barrel joints in a scaled condition. The backfill may be carefully jetted with water to achieve initial settlement. Following initial settlement, the top of the manhole cover frame shall then be set in place using the frame lugs to center the frame over the opening. It is intended that the frame to top of cone seal shall be watertight. The manhole cover shall then be put in place. Following placement of the manhole frame and cover, the backfill operation shall proceed to the top of the manhole frame and cover.

All backfill operations shall be in accordance with the applicable Articles of the specifications. All manhole construction, frame and cover, etc., shall be in accordance with the plan details and notations.

PART 12 – TESTING OF GRAVITY SEWERS

The extent of testing shall be at the discretion of the owner and engineer and paid for by the contractor.

12.1 GENERAL

After construction and backfilling are completed and before any services are connected the sewers, the completed lines shall be tested for leaks, and visually checked for straightness of line and cracked pipe. If any deficiencies in line or grade are found which will be detrimental to the proper functioning of the sewer, the deficiencies shall be corrected. Any damaged or cracked pipe shall be excavated and re-laid in a manner satisfactory to the Owner. Any section of sewer, which is found to be leaking in excess of the allowable quantity, shall be repaired.

12.2 ACCEPTANCE TESTS

A. Each reach of sewer shall meet the requirements of the following shall be repaired to the satisfaction of the Owner.

1. Upon completion of the sewers, acceptance tests will be conducted by the Contractor in the presence of the Engineer to determine the acceptability of the sewers. The testing schedule shall be submitted to the Engineer by the Contractor prior to testing. The Contractor shall furnish suitable test equipment, materials and manpower to conduct the test.

2. All completed pipe sewers shall be subject to an exfiltration test. The sewer pipe shall sustain a maximum limit of 200 gallons per inch of diameter per day per mile. The exfiltration test shall cover a period of at least four continuous and connective hours. For purposes of

determining maximum allowable leakage, manholes shall be considered a section of 48-inch pipe.

3. No ground water in an amount greater than that allowed and specified herein for the exfiltration test shall be permitted.

4. Any completed pipe sewers not conforming to the tests herein specified or conforming to all requirements of the specifications, plans and profiles, or subject to any irregularity of construction shall be removed and replaced.

5. The Contractor shall cooperate fully with the Engineer for the inspection and testing of the completed work.

6. Stoppers and/or plugs for the various sizes of pipe shall be furnished by the Contractor for use in the tests and personnel shall be made available by the Contractor for aid in conducting the tests herein specified.

7. As an alternate to the exfiltration test, a low-pressure air test may be conducted after backfilling and before replacing pavement. The equipment shall be provided and tests shall be conducted by the Contractor in the presence of the Engineer.

8. The Contractor may desire to make an air test prior to backfill for his own purpose, but "Acceptance Test" shall be conducted after backfill.

9. All wyes, tees or ends of lateral or service stubs shall be suitably capped to withstand the internal pressure during testing. Such caps shall be easily removable for future connections or extensions.

10. After each manhole-to-manhole section of line has been backfilled and cleaned, the ends shall be plugged with pneumatic plugs. These plugs shall be designed such that they will hold against line test pressure without requiring blocking or bracing. All pneumatic plugs shall pass a qualifying test in the presence of the Engineer before actual line testing as follows: One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs being tested. Air shall be introduced into the pipe until the pipe pressure reaches 15 psi. The pneumatic plugs shall hold against this pressure without bracing and movement of the plugs.

11. Air for inflation of the triple connection pneumatic plug shall be supplied through a factory-equipped control panel. There shall be three hose connections from the control panel to the triple connection pneumatic plug. One hose shall be used only for inflation of the pneumatic plug. The second hose shall be used for continuously reading the air pressure rise in the sealed line.

12. There shall be a 3 ½" diameter, 0-30 psig gauge mounted on the control panel for reading the internal pressure of the line being tested. Calibrations from the o-10 psig range shall be in tenths of pounds (not ounces) and this 0-10 portion shall cover 90% of the completed dial range.

13. Low pressure air shall be introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any ground water pressures that may be

over the pipe. At least two minutes shall be allowed for the air pressure to stabilize. After the stabilization period, the third hose shall be quickly disconnected from the control panel.

14. The portion of line being tested shall be accepted if the portion under test does not lose air at a rate greater than 0.0015 cfm per square foot of internal pipe surface when tested 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 the test.

15. The above requirement shall be accomplished by performing the test as follows. The time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table (See Table 3 this Section):

TABLE 3

PIPE DIAMETER INCHES	MINIMUM TIME MN: SEC	LENGTH FOR MINIMUM TIME FEET	TIME FOR LONGER LENGTHS SECONDS
4	3:46	597	3.380 L
6	5:40	398	0.654 L
8	7:34	298	1.520 L
10	9:25	239	2.374 L
12	11:20	189	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470 L
24	22:40	99	13.574 L
27	25:30	88	17.306 L
30	28:20	80	21.366 L
33	31:10	72	25.852 L
36	34:00	66	30.768

16. In areas where ground water is known to exist, the Contractor shall install a ½" diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of on one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, the ground water level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to readings.

17. If the installation fails to meet this requirement, the Contractor shall determine at his own expense the source of the leakage. He shall repair or replace all defective materials and/or workmanship. The use of sewer scaling materials and methods shall not be used or accepted.

18. There shall be no substitute for good construction. The replacement of any pipes, pipe or fraction thereof shall require the end connections to be made with factory manufactured pieces having flexible gasketed joints to fit intended use. The use of half bell pipe and/or

concrete collar will not be acceptable. Test shall be repeated as often as necessary until the installation meets the requirements of the acceptance test.

19. Pipe Deflection: Each segment of P.V.C. sewer main shall be tested for deflection. The test shall consist of pulling a mandrel through each segment of P.V.C. pipe. The mandrel shall be an object having a cross-section, or same shall be a ball, having a diameter equal to 95% of the nominal pipe inside diameter. A steel cable of adequate known length and strength characteristics, shall be used to pull the mandrel through the piping. In the event of a failure, the failure location shall be found by measurement and the piping shall be repaired or replaced as required. After failure correction, the segment shall be re-tested. This process shall be repeated as often as necessary.

    It is recommended that the test for deflection precede the test for infiltration and exfiltration. The Contractor shall furnish all equipment as required to perform all testing as specified. All tests shall be conducted in the presence of the Engineer.

20. After completion of aforementioned testing, each manhole shall be subjected to any exfiltration test. The manhole to be tested shall be isolated from the sewer lines by installing pneumatic plugs in the sewer lines using the same procedure as for air testing, except that the plugs shall be installed in such a manner that there is a clear distance of at least 18” between the inside face of the manhole and the face of the plug. The manhole shall be tested by one of the two methods discussed below.

12.3 WATER TEST

The manhole shall then be filled completely with water. Depth of water shall be at least 3’ above ground water. A liquid level measurement shall be made and recorded after initial filling and 15 and 30 minutes thereafter. The test is acceptable when the water loss observed is less than 0.1 gallon/foot diameter/foot head/hour. Addition of water during the testing shall not be allowed.

12.4 VACUUM TEST

All lift holes and any pipes entering the manhole are to be plugged. A vacuum will be drawn and the vacuum drop over a specified time period is used to determine the acceptability of the manhole. The values recorded are applicable only to the manhole being tested and at the time of testing.

The test results will be greatly affected by the preparation of the manhole. All lift holes shall be plugged completely. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

A. Procedure

1. The test head shall be placed at the top of the manhole in accordance with the manufacturer’s recommendations.

2. A vacuum of 10 in. of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 in. of mercury.

3. The manhole shall pass if the time for the vacuum reading to drop from 10 in. of mercury to 9 in. of mercury meets or exceeds the values indicated in Table 1.

4. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

Minimum Test Times for Various Manhole Diameters – Vacuum Test – Table 1

Depth (ft)	**Diameter (Inches)**								
	30	33	36	42	48	54	60	66	72
	Times (Seconds)								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	48	51	57
18	22	24	30	34	40	45	52	58	67
18	25	27	32	35	45	52	58	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	45	55	54	72	79	89
24	33	36	42	51	59	64	78	87	97
26	38	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

21. All sewer pipes shall be flushed to remove any debris, sand or grit from the completed sewers prior to being placed in service. The Contractor shall flush and pump or remove all water from the flushing process.

22. Each section of the sewer line between manholes is required to be straight and uniformly graded. Each section will be lamped in the presence of the Engineer.

PART 13 – INITIAL CLEAN UP, GRADING, AND REPLACEMENT

The Contractor shall provide the necessary labor and equipment to permit initial clean up as the sewer main is being installed. Immediately following trench backfill, all areas disturbed by excavation shall be graded to conform to the adjacent ground levels. Earth shall be neatly mounded over the trench location. All debris, of whatever nature, due to the sewer main and service installation, shall be picked up and disposed of. All walks, driveways, roads, streets, etc., shall be replaced to original condition.

PART 14 – FINAL CLEAN UP, FINISH GRADING, SEEDING, AND STRAW

Following completion of the various routes and initial trench settlement, the Contractor shall go over the routes and clean-up all remaining debris. Following completion of the final clean up, all areas in any way disturbed by the installation shall be graded to conform to the adjacent ground areas. After final grading, the graded areas shall be seeded and covered with straw. In areas of rock excavation, it will be necessary to place a four inch layer of earth over the exposed areas to form a seed bed for vegetation. The earth shall be applied as part of the final grading operation.

PART 15 – GUARANTEE

The Contractor shall guarantee all materials and workmanship in any way involved with this project for a period of one year from the date of final acceptance. Date of final acceptance is hereby defined as being the date on which the Board of Directors accepts the improvements.

END OF SECTION 335100