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SECTION 02561

SANITARY SEWERS AND SANITARY HOUSE CONNECTIONS

02561.01 GENERAL

A. Description

Sanitary sewer and sanitary house connection installation shall include, but not necessarily be limited to furnishing and installing gravity pipe, fittings, and appurtenances of the size and type shown on the Plans, installed on firm foundation true to line and grade and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Protection of the environment; Section 01500.
2. Trench excavation, backfill, and compaction; Section 02250.
3. Sanitary sewer manhole installation; Section 02562.
4. Connection to existing sanitary sewer facilities; Section 02564.

C. Quality Assurance

1. Materials

- a. The County will inspect all materials before and after installation to ensure compliance with the Contract Documents. When specific materials tests are called for in the referenced standards and specifications, the County will have the option of requiring that any or all of these tests be performed for materials furnished for a specific project. When testing is required, it will be specified in the "Special Provisions" or on the plans.
- b. Polyvinyl chloride (PVC) pipe and fittings shall be homogeneous throughout and free from visible cracks, bubbles, blisters, holes, foreign inclusions, cuts, or scrapes on inside or outside surfaces or imperfections which may impair the performance or life of the pipe. Each pipe shall be straight to within 1/16 inch per foot of length when uniformly supported along its entire length, and shall have a true circular cross-section to within + 1/64-inch.
- c. Reinforced concrete pipe (RCP) and fittings shall be free from fractures or cracks that extend through the wall of the pipe or fitting, surface defects indicating honeycombed or open texture, damaged or cracked ends where such damage would prevent making a satisfactory joint, or any continuous crack having a surface width of 0.01 inch or more and extending for a length of 12 inches or more.

Materials and finished product testing shall be in accordance with ASTM C 76, as detailed in ASTM C 497, and as specified herein. Acceptability of pipe through 54-inch diameter and

classes produced in accordance with design tables found in ASTM C 76, or the modified and special designs permitted therein, shall be determined by results of a three-edge bearing test for a load to produce a 0.01-inch crack. If the load exceeds the requirements before the 0.01-inch crack is reached, the load may be relieved and the pipe accepted for use. For pipe 60-inch diameter and larger, acceptance will be based on materials tests specified in ASTM C 76.

- d. Cast iron soil pipe, ductile iron pipe (DIP), and ductile iron and cast iron fittings shall be sound and without defects that might impair its service. Defective or damaged lining areas may be repaired by cutting out the defective or damaged lining to the metal so that the edges of the lining not removed are perpendicular or slightly undercut. The cut-out area and the adjoining lining shall be thoroughly wetted, and a stiff mortar applied and troweled smooth with the adjoining lining. After any surface water has evaporated, but while the patch is still moist, it shall be cured by the application of a seal coat.

2. Field Tests

a. General

- 1) After installation, sanitary sewers and sanitary house connections will be initially inspected for Substantial Completion acceptance by the County and Contractor tested for compliance with these Specifications. Initial inspections and tests will not be conducted until at least 15 days after the section of pipeline being inspected and tested has been backfilled in accordance with Section 02250.03 and any dewatering pumps removed from the area.
- 2) The Contractor shall schedule all tests with the County at least 48 hours in advance of the test, and shall conduct all acceptance testing in the presence of the County. The County will witness one test and perform one Substantial Completion Inspection and one Final Inspection at no cost to the Contractor. If the project is released for service following Substantial Completion acceptance tests, the County will perform a final inspection if required at no cost to the Contractor. Should the pipeline fail the first County witnessed test, the Contractor shall reimburse the County for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the County for the cost of inspection if the Contractor is not prepared for any test, additional retests, and additional Substantial Completions including Partial Substantial Completion Inspections or additional Final Inspections. Reimbursement shall be made prior to the next Substantial Completion or Final Inspection.

b. Visual Inspection

Equipment necessary for the inspection may be furnished by the County, however, the Contractor shall provide assistance or equipment as may be required to enable the County to perform the inspection.

The County will inspect all sanitary sewers for alignment, grade, leakage, and condition. The inspection may be conducted by crawling or walking through the pipeline, using mirrors to reflect light through the pipeline, or closed circuit television equipment.

- 1) If a mirror test is used, the pipe alignment will be acceptable if it is sufficiently true and straight to allow passage of the reflected light with an image of a "full moon."
 - 2) The pipeline shall be installed on a continuous grade so it does not pond or trap water anywhere along the line.
 - 3) No visible infiltration will be allowed. Any water leakage into the system sufficient to constitute any noticeable trickle or dribble shall be corrected and eliminated.
 - 4) The pipeline shall not contain any debris, silt, earth, gravel, rock, or other foreign material. Should the pipeline require flushing, it shall be done in a manner to prevent debris or flushing water from entering the existing sewer and before inspection by the County.
- c. Acceptance Testing

- 1) General
 - a. The Contractor shall furnish all labor, tools, materials, and equipment (as approved by the County) necessary to perform the specified tests. Testing shall be conducted only after the section of sewer in question has passed the visual inspection.
 - b. Generally sewers will be tested from manhole to manhole or from manhole to terminus of the pipeline if there is no manhole at the other extremity. Testing shall be by low pressure air and/or infiltration/exfiltration as specified herein and/or as determined by the County.
 - c. If the sanitary sewer or sanitary house connection fails any test specified herein, the Contractor shall, at the Contractor's own expense, repair or replace any defective component and retest the failed section or component until all requirements are met. Repairs to defective material are to be made in accordance with the manufacturer's recommendation as approved by the County.
- 2) Low Pressure Air Test

Sanitary sewers 27 inch diameter and smaller and attached sanitary house connections shall be tested with low pressure air in accordance with the air test table shown below and the following procedures:

- a. Test plugs and all air testing equipment shall be supplied and installed by the Contractor within the pipeline at each manhole. Each plug shall be securely braced.
- b. If the pipeline to be tested is expected to be below the ground water table, the County may visually inspect the trench prior to backfilling to determine the

elevation of the groundwater table. In lieu of this, the Contractor shall either install a small diameter perforated vertical pipe from the invert elevation of the sewer to the surface before backfilling or shall insert a pipe probe by boring or driving into the backfill material adjacent to the invert elevation of pipe and determine the depth of the ground water level above the pipe invert immediately before air testing the sewer. All gauge pressures for the test shall be increased by an amount to provide 4 psig above the back pressure due to ground water submergence over the end of the probe to a maximum of 6 psi in the pipe system to be tested except as required by Paragraph 2) i) below. After the pipeline has passed the low pressure air test, the small diameter vertical pipe shall be either withdrawn, filling the hole with concrete while removing the pipe; or abandoned in place by filling with concrete or bentonite and cutting the pipe off at least 2 feet below the finished surface.

- c. If the air pressure required for the test is greater than 6 psig at the downstream end, the pipeline shall not be air tested, but rather shall be tested for infiltration in accordance with method indicated in Paragraph 3) which follows.
- d. The Contractor shall add air slowly to the portion of the pipeline under test until the internal pressure is raised to 4.0 psig greater than the average back pressure of any groundwater above the pipe's invert.
- e. The Contractor shall not allow personnel in manholes after the air pressure is increased in the sewer. If the test plug is suspected of leaking, the Contractor shall first relieve the pressure before any adjustments are made to eliminate air leakage at the plug. The Contractor may precoat the plug with a soap solution to check for leakage.
- f. When air pressure is stabilized, disconnect hose and compressor and allow pressure to decrease to 3.5 psi, plus correction for groundwater backpressure.
- g. Record time period for pressure drop 0.5 psi, from 3.5 to 3.0 psi plus groundwater correction.
- h. Pipes failing to maintain holding times in air test tables herein will not be accepted. If test section fails test:
 - i. Make repairs or replace
 - ii. Retest as specified herein
- i. Where there are potable water wells within 50 feet of the sewer being tested, the test will be conducted at 10 psig and no pressure drop will be allowed over a 5 minute test period.

AIR TEST TABLES – ALL PIPES OTHER THAN RCP

Minimum Holding Time in Minutes: Seconds Required
For Pressure Drop from 3.5* to 3.0* PSIG

		PIPE DIAMETER											
		4"	6"	8"	10"	12"	15"	16"	18"	20"	21"	24"	27"
LENGTH OF TEST STATION	25	2:00	3:00	4:00	4:30	5:30	7:00	7:30	8:30	9:30	10:00	11:30	14:30
	50												
	75												
	100									9:30	10:00	11:30	14:30
	125								8:30	10:00	11:00	14:30	18:00
	150						7:00	7:30	9:30	12:00	13:00	18:00	21:30
	175						8:00	9:00	11:00	14:00	15:30	20:00	25:00
	200					5:30	9:00	10:00	13:00	16:00	17:30	23:00	29:00
	225				4:30	6:30	10:00	11:30	14:30	18:00	19:30	25:30	32:30
	250				5:00	7:00	11:00	12:30	16:00	20:00	22:00	28:30	36:00
	275				5:30	8:00	12:30	14:00	17:30	22:00	24:00	31:30	39:40
	300				6:00	8:30	13:30	15:00	19:00	24:00	26:00	34:00	43:30
	325				6:30	9:30	14:30	16:30	21:00	25:30	28:30	37:00	47:00
	350			4:30	7:00	10:00	15:30	17:30	22:30	27:30	30:30	40:00	50:30
	375			5:00	7:30	10:30	16:30	19:00	24:00	29:30	32:30	42:30	54:00
	400	2:00	3:00	5:00	8:00	11:30	18:00	20:30	25:30	31:30	35:00	45:30	57:30

*Test pressures shall be increased by amount of groundwater backpressure at springline of pipe, but shall not exceed 5.5 PSIG.

NOTE: For test sections with a minimum holding time exceeding 5 minutes: If gauge needle has dropped 0.0 PSIG from starting pressure after 5 minutes, section will be considered to have passed air test.

RCP PIPE – AIR TEST TABLE

Minimum Holding Time in Minutes: Seconds Required
For Pressure Drop from 3.5* to 3.0* PSIG

	PIPE DIAMETER						
	18"	21"	24"	27"	30"	33"	36"
25	1:00	1:00	1:00	1:00	1:00	1:30	1:30
50	1:00	1:30	2:00	2:00	2:30	2:30	3:00
75	2:00	2:00	2:30	3:00	3:30	4:00	4:30
100	2:30	3:00	3:30	4:00	5:00	5:30	6:00
125	3:00	3:30	4:30	5:30	6:00	7:00	7:30
150	3:30	4:30	5:30	6:30	7:00	8:00	9:00
175	4:00	5:00	6:00	7:30	8:30	9:30	10:30
200	5:00	6:00	7:00	8:30	9:30	11:00	12:00
225	5:30	6:30	8:00	9:30	11:00	12:00	13:30
250	6:00	7:30	9:00	10:30	12:00	12:00	15:00
275	6:30	8:00	9:30	11:30	13:00	13:30	16:30
300	7:00	9:00	10:30	12:30	14:30	15:00	18:00
325	8:00	9:30	11:30	13:30	15:30	16:00	19:30
350	8:30	10:30	12:30	14:30	17:00	17:30	21:00
375	8:30	11:00	13:30	16:00	18:00	19:00	22:30
400	9:30	12:00	14:00	17:00	19:00	20:30	24:00
425	10:00	12:30	15:00	18:00	20:30	21:30	25:30
450	11:00	13:30	16:00	19:00	21:30	23:00	27:00
475	11:30	14:00	17:00	20:00	23:00	24:30	28:30
500	12:00	15:00	18:00	21:00	24:00	27:00	30:00
525	12:30	15:30	18:30	22:00	25:00	28:30	31:30
550	13:00	16:30	19:30	23:00	26:30	29:30	33:00

LENGTH OF TEST STATION

*Test pressures shall be increased by amount of groundwater backpressure at springline of pipe, but shall not exceed 5.5 PSIG.

NOTE: For test sections with a minimum holding time exceeding 5 minutes: If gauge needle has dropped 0.0 PSIG from starting pressure after 5 minutes, section will be considered to have passed air test.

AIR TEST TABLES FOR MAIN LINE WITH SERVICE CONNECTION

Minimum holding time in Minutes: Seconds required for pressure drop from 3.5* psig to 3.0 psig. *Test pressures shall be increased by amount of groundwater backpressure at springline of pipe but shall not exceed 5.5 PSIG

NOTE: For sections with a minimum holding time exceeding 5 minutes: If gauge needle has dropped 0.0 psig from starting pressure after 5 minutes, section will be considered to have passed air test.

Length of 6-inch diameter Main Line in Test Section, in Feet

		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
4 inch diameter	50	4:30	5:00	5:00	5:00	5:30	5:30	5:30	5:30	5:30	5:30	5:30	5:30	5:30	5:30	5:30	6:00
	100	4:30	4:30	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:30	5:30	5:30	5:30	5:30	6:00	6:30
	150	4:00	4:30	4:30	4:30	5:00	5:00	5:00	5:00	5:00	5:00	5:00	6:00	5:30	6:00	6:30	6:30
	200	4:00	4:30	4:30	4:30	4:30	5:00	5:00	5:00	5:00	5:00	5:00	6:00	6:00	6:00	6:30	7:00
	250	4:00	4:00	4:30	4:30	4:30	4:30	4:30	5:00	5:00	5:00	5:30	6:30	6:00	6:30	7:00	7:30
	300	4:00	4:00	4:30	4:30	4:30	4:30	4:30	4:30	5:00	5:30	6:00	7:00	6:30	7:00	7:30	7:30
	350	4:00	4:00	4:30	4:30	4:30	4:30	4:30	5:00	5:30	6:00	6:00	7:00	7:00	7:00	7:30	8:00
	400	4:00	4:00	4:00	4:00	4:00	4:00	5:00	5:30	5:30	6:00	6:30	7:30	7:00	7:30	8:00	8:30

Length of 8-inch diameter Main Line in Test Section, in Feet

		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
4 inch diameter	50	5:30	6:30	6:30	7:00	7:00	7:00	7:00	7:00	7:00	7:00	7:30	8:00	8:30	9:00	10:00	10:30
	100	5:00	5:30	6:00	6:30	6:30	6:30	6:30	7:00	7:00	7:00	7:30	8:00	9:00	9:30	10:00	11:00
	150	4:30	5:30	5:30	6:00	6:00	6:30	6:30	6:30	6:30	7:30	8:00	8:30	9:00	10:00	10:30	11:00
	200	4:30	5:00	5:30	5:30	6:00	6:00	6:00	6:30	7:00	7:30	8:00	9:00	9:30	10:00	11:00	11:30
	250	4:30	5:00	5:00	5:30	5:30	6:00	6:00	6:30	7:30	8:00	8:30	9:00	10:00	10:30	11:00	11:30
	300	4:30	4:30	5:00	5:30	5:30	5:30	6:30	7:00	7:30	8:00	9:00	9:30	10:00	11:00	11:30	12:00
	350	4:00	4:30	5:00	5:00	5:30	6:00	6:30	7:30	8:00	8:30	9:00	10:00	10:30	11:00	11:30	12:30
	400	4:00	4:30	5:00	5:00	5:30	6:30	7:00	7:30	8:00	9:00	9:30	10:00	11:00	11:30	12:00	12:30

Length of 8-inch diameter Main Line in Test Section, in Feet

		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
6 inch diameter	50	6:30	6:30	7:00	7:00	7:00	7:00	7:00	7:30	7:30	7:30	7:30	8:30	9:00	9:30	10:00	11:00
	100	6:00	6:30	6:30	6:30	7:00	7:00	7:00	7:00	7:00	8:00	8:30	9:00	9:30	10:30	11:00	11:30
	150	6:00	6:00	6:30	6:30	6:30	6:30	7:00	7:00	8:00	8:30	9:00	9:30	10:30	11:00	11:30	12:30
	200	6:00	6:00	6:30	6:30	6:30	6:30	7:30	8:00	8:30	9:00	10:00	10:30	11:00	11:30	12:30	13:00
	250	6:00	6:00	6:00	6:30	6:30	7:30	8:00	8:30	9:30	10:00	10:30	11:00	12:00	12:30	13:00	13:30
	300	6:00	6:00	6:00	7:00	7:30	8:00	8:30	9:30	10:00	10:30	11:00	12:00	12:30	13:00	14:00	14:30
	350	6:00	6:00	7:00	7:30	8:00	9:00	9:30	10:00	10:30	11:30	12:00	12:30	13:00	14:00	14:30	15:00
	400	6:30	7:00	7:30	8:30	9:00	9:30	10:30	11:00	11:30	12:00	12:30	13:30	14:00	14:30	15:00	16:00

AIR TEST TABLES FOR MAIN LINE WITH SERVICE CONNECTION (Cont.)

Length of 10-inch diameter Main Line in Test Section, in Feet

		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
4 inch diameter	50	7:00	8:00	8:00	8:30	8:30	9:00	9:00	9:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00
	100	6:00	7:00	7:30	8:00	8:00	8:00	8:30	8:30	9:30	10:30	11:30	12:30	13:30	14:30	15:30	16:30
	150	5:30	6:30	7:00	7:00	7:30	8:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
	200	5:00	6:00	6:30	7:00	7:00	7:30	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
	250	5:00	5:30	6:00	6:30	7:00	7:30	8:30	9:30	10:30	11:30	12:30	13:30	14:30	15:30	16:30	17:30
	300	4:30	5:30	6:00	6:30	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	16:30	17:30
	350	4:30	5:30	5:30	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
	400	4:30	5:00	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:30	13:30	14:30	15:30	16:30	17:30	18:30

Length of 10-inch diameter Main Line in Test Section, in Feet

		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
6 inch diameter	50	7:30	8:00	8:30	8:30	8:30	9:00	9:00	9:00	9:30	10:30	11:30	12:30	13:30	14:30	15:30	16:30
	100	7:00	7:30	8:00	8:00	8:00	8:30	8:30	9:30	10:30	11:30	12:30	13:30	14:30	15:30	16:30	17:00
	150	6:30	7:00	7:00	7:30	8:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
	200	6:30	7:00	6:30	7:30	8:00	9:00	10:00	11:00	12:00	12:30	13:30	14:30	15:30	16:30	17:30	18:30
	250	4:30	5:30	5:30	7:30	8:30	9:30	10:30	11:30	12:30	13:30	14:30	15:30	16:30	17:30	18:30	19:30
	300	6:00	6:30	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
	350	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
	400	6:30	7:30	8:30	9:30	10:30	11:30	12:30	13:30	14:30	15:30	16:30	17:30	18:30	19:30	20:30	21:30

Length of 12-inch diameter Main Line in Test Section, in Feet

		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
4 inch diameter	50	8:30	9:30	10:00	10:30	10:30	10:30	10:30	11:30	13:00	14:30	16:00	17:30	19:00	20:30	21:30	23:00
	100	7:00	8:30	9:00	9:30	10:00	10:00	10:30	12:00	13:30	15:00	16:30	17:30	19:00	20:30	22:00	23:30
	150	6:30	7:30	8:30	9:00	9:00	9:30	11:00	12:30	14:00	15:00	16:30	18:00	19:30	21:00	22:30	23:30
	200	6:00	7:00	8:00	8:30	8:30	10:00	11:00	12:30	14:00	15:30	17:00	18:30	20:00	21:00	22:30	24:00
	250	5:30	6:30	7:30	8:00	8:30	10:00	11:30	13:00	14:30	16:00	17:00	18:30	20:00	21:30	23:00	24:30
	300	5:30	6:30	7:00	7:30	9:00	10:30	12:00	13:30	14:30	16:00	17:30	19:00	20:30	22:00	23:00	24:30
	350	5:00	6:00	6:30	8:00	9:30	11:00	12:00	13:30	15:00	16:30	18:00	19:30	20:30	22:00	23:30	25:00
	400	5:00	6:00	7:00	8:00	9:30	11:00	12:30	14:00	15:30	17:00	18:00	19:30	21:00	22:30	24:00	25:30

Length of 12-inch diameter Main Line in Test Section, in Feet

		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400
6 inch diameter	50	8:30	9:30	10:00	10:00	10:00	10:30	10:30	12:00	13:30	15:00	16:30	18:00	19:00	20:30	22:00	23:30
	100	7:30	8:30	9:00	9:30	9:30	10:00	11:30	13:00	14:00	15:30	17:00	18:30	20:00	21:30	23:00	24:00
	150	7:00	8:00	8:30	9:00	9:30	10:30	12:00	13:30	15:00	16:30	18:00	19:00	20:30	22:00	23:30	25:00
	200	7:00	7:30	8:00	8:30	10:00	11:30	13:00	14:00	15:30	17:00	18:30	20:00	21:30	23:00	24:00	25:30
	250	6:30	7:30	8:00	9:30	10:30	12:00	13:30	15:00	16:30	18:00	19:00	20:30	22:00	23:30	25:00	26:30
	300	6:30	7:00	8:30	10:00	11:30	13:00	14:00	15:30	17:00	18:30	20:00	21:30	23:00	24:00	25:30	27:00
	350	6:30	8:00	9:30	10:30	12:00	13:30	15:00	16:30	18:00	19:00	20:30	22:00	23:30	25:00	26:30	28:00
	400	7:00	8:30	10:00	11:30	13:00	14:00	15:30	17:00	18:30	20:00	21:30	23:00	24:00	25:30	27:00	28:30

j. TV Test – Need additional information.

3) Infiltration/Exfiltration Tests

Sanitary sewers 30-inch diameter and larger and sewers which cannot be air tested in accordance with Paragraph 2, Item C, 2) of this Article shall be subjected to either infiltration or exfiltration tests as determined by the County. Testing may be conducted from manhole to manhole, or between more than two manholes, however, the length to be tested shall not exceed 700 feet. Minimum test duration shall be 24 hours. Testing shall be conducted in accordance with ASTM C 969 as modified herein.

a. Infiltration test shall be made by measuring the amount of water infiltrating into the pipeline section at the lower end of the section being tested by means of a weir installed in the pipe or by other measurement method approved by the County.

b. Exfiltration test shall be made by plugging the lower manhole, filling the pipeline section with water to a level of at least 2 feet above the crown of the pipe at the upstream end of the section being tested or 2 feet above groundwater level whichever is greater and measuring the quantity of water added to maintain the prescribed level during the test period. Concrete pipeline shall be filled with water for at least 20 hours immediately before the test.

c. Test Criteria

Unless otherwise noted, no leakage shall be allowed in the completed sewer.
Discuss

4) Deflection Testing

In addition to other tests detailed in this Section, all PVC sanitary sewers shall be tested for deflection (reduction in vertical inside diameter). Testing shall be performed by passing a 5% undersized GO/NO-GO mandrel or sewer ball through the pipeline or measuring deflection continuously by using a deflectometer. Maximum allowable deflection shall be 5%. This equipment shall be provided by the Contractor. The Contractor shall also perform deflection testing in the presence of the County. Deflection testing shall only be done after the pipelines have been cleaned.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for the following materials, and shall include the following information:

a. Polyvinyl chloride (PVC) pipe and fittings: product information and dimensions; storage, handling, installation recommendations, and recommendations for field repairs.

- b. Reinforced concrete pipe and fittings: concrete compressive strength; wall, joint, gasket, and reinforcing dimensions; reinforcing, joint, and special fitting details; and pipe Class when indicated on the Plans.

For pipe designated on the Plans by D loads, calculations signed by a Professional County registered in the State of Maryland shall be furnished.

- c. Cast iron soil pipe, ductile iron pipe and fittings, and cast iron fittings: product information and dimensions; storage, handling, and installation recommendations.
- d. Pipeline plugs and adapters: product information and installation guides.

2. Certificates of Compliance

Certificates of compliance shall be submitted in accordance with the "General Provisions" for the following materials stating the item supplied is in accordance with the requirements specified herein:

- a. Polyvinyl chloride (PVC) pipe and fittings
- b. Reinforced concrete pipe and fittings
- c. Cast iron soil pipe and fittings
- d. Ductile iron pipe and fittings
- e. Cast iron fittings

3. Certified Test Results

Certified test results shall be submitted as specified in the "General Provisions" for the following:

- a. Polyvinyl chloride (PVC) pipe and fittings
- b. Reinforced concrete pipe and fittings
- c. Cast iron soil pipe and fittings
- d. Ductile iron pipe and fittings
- e. Cast iron fittings

02561.02 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for sanitary sewers and sanitary house connections.

2. The Contractor may obtain potable water from the County's potable system for flushing the pipelines and exfiltration testing. All use of potable water from the County system must be metered. The Contractor shall contact the Department of Public Works for requirements. A backflow prevention device must be placed in accordance with the Standard Details prior to drawing County water.

B. Detailed Material Requirements

1. Portland cement concrete for pipe cradle and encasement shall be Mix No. 1 as specified in Section 03310.02.
2. Polyvinyl Chloride (PVC) Pipe and Fittings
 - a. SDR-35 PVC Pipe:
 - 1) Use and application of this pipe and fittings, as it relates to Sanitary Sewer, shall only be for gravity sanitary sewer. Pipe and fittings 4 inch through 15 inch diameter shall meet the material requirements of ASTM D-3034, wall thickness classification ASTM F-789, wall thickness T-1. Pipe and fittings 18 inch through 27 inch diameter shall meet the material requirements of ASTM F-679, wall thickness T-1. Fittings shall meet or exceed ASTM D-1784, ASTM D-3034, ASTM D-3212-76, and ASTM F-477 specifications. Fittings shall be HARCO SDR-35 Gasketed Sanitary Sewer Fittings or County approved equal.
 - 2) Use of SDR-35 PVC pipe and fittings will not be allowed when the depth of cover exceeds 15 feet.
 - 3) Joints shall be elastometric gasketed, per ASTM F-477.
 - 4) Use of this material is only upon approval of the County.
 - b. C-900 and C-905 PVC PIPE:
 - 1) Use and application of these pipes and fittings, as it relates to Sanitary Sewer, shall only be for Gravity Sanitary Sewer from 4 inches through 12 inches use AWWA C900 and for 14 inches and larger use AWWA C-905. Minimum Class Rating for both pipes shall be DR-18. Pipe shall conform to AWWA C-900 and AWWA C-905, "Standard for Polyvinyl Chloride (PVC) Pressure Pipe", and shall be furnished in cast-iron pipe equivalent outside diameters. Pipes shall be as manufactured by the Diamond Plastic Corp, or County approved equal.
 - a. All PVC fittings for C-900 and C-905 PVC Pipes shall be manufactured in one piece of injection molded PVC compound conforming to ASTM D-1784. Fittings shall conform to the thickness and class rating of DR-18. Fittings shall be manufactured to withstand 755 psi quick burst pressure tested in accordance with ASTM D-1599 and withstand 500 psi for a minimum of 1,000 hours tested in accordance with

ASTM D-1598. Fittings shall also conform to Dimensional Checks, per ASTM D-2122, and Acetone Tests, per ASTM D-2152.

- b. Ductile Iron fittings with mechanical or push on joints conforming to AWWA C-153 or C-110 shall be allowed as alternative when PVC sizes are not available. Cast Iron fittings are an approved substitute for Ductile Iron, if Ductile Iron fittings are not manufactured and must conform to the same AWWA standards. Fittings shall be as manufactured by the Harrington Corporation (HARCO), or County approved equal.
- 2) Use of C-900 PVC pipe and fittings will not be allowed when the depth of cover exceeds 25 feet.
- 3) Bells shall be gasketed push on type conforming to ASTM D-3139 with elastometric gaskets conforming to ASTM F-477.
- c. Schedule 40 PVC Pipe:
 - 1) Use and application of this pipe and fittings, as it relates to Sanitary Sewer, shall only be for gravity sanitary sewer from 4 inches through 6 inches. Schedule 40 PVC shall only be permitted to be used as a lateral service connection from the public right-of-way line or public easement to the dwelling. Pipe and fittings shall conform to ASTM 1785 NSF/PW and ASTM 2665 NSF/SWV. Installation shall be in strict conformance with ASTM and the manufacturers instructions.
 - 2) Use of Schedule 40 PVC pipe and fittings will not be allowed when the depth of cover exceeds 15.
 - 3) Joints shall be approved solvent weld, per ASTM and the manufacturers instructions.
- d. Use of PVC Pennella Caps for sanitary sewer clean-outs are not permitted. Only Cast Iron Pennella Caps with brass tops are allowed in accordance with the Standard Details.

3. Reinforced Concrete Pipe (RCP) and Fittings

Use and application of this pipe and fittings, as it relates to sanitary sewer, shall only be for gravity sanitary sewer 54-inches and larger. Circular reinforced concrete pipe and fittings shall meet the material requirements of ASTM C 76 as modified herein. For design purposes, bedding shall be Class "D" bedding as defined by the American Concrete Pipe Association. Maximum trench widths shall be as indicated in the Standard Details. The pipe class, when designated on the Plans, is in accordance with ASTM C 76 and indicates the external load crushing strength.

- a. Portland cement shall be Type II in accordance with ASTM C 150.
- b. Coarse aggregate for concrete shall consist of hard, durable particles of crushed limestone which shall conform to the requirements and tests specified in ASTM C 76.
- c. No elliptical reinforcement will be permitted.

- d. Longitudinal reinforcing steel shall extend to within 3/4 inch of the terminal faces of the pipe, whether barrel, bell or spigot. Longitudinal bars shall be bent or crimped to provide full cover at the bell.
 - e. Minimum concrete cover over all reinforcement shall be 3/4 inch, except where the groove intrudes into the spigot.
 - f. The circumferential steel shall terminate in at least one full circular ring of the same size as is in the barrel of the pipe at both ends of pipe; viz. in both bell and spigot. This hoop shall be no more than 1 inch from the terminal face of the pipe unit. Spacing of circumferential steel in bell and spigot ends shall not be more than 1 inch.
 - g. Pipe shall have bell and spigot ends with rubber gasket joints meeting material requirements of ASTM C 361. Joints may be either steel and rubber or concrete and rubber. For pipe 24-inch and larger with steel and rubber joints, the outside of the joint shall be protected by use of a diaper filled with cement grout or other protective methods approved by the County and the inside of the joint filled with mortar or other approved material.
 - h. Rubber gaskets, whether used in conjunction with steel joint rings or concrete ends, shall be the sole element depended upon to make the joint watertight under all conditions, including movement due to expansion, contraction, and normal settlement. Joints shall be made according to the manufacturer's recommendations.
 - i. Concrete Y-branches or tee fittings and bends shall be fabricated and assembled in the manufacturing plant. The fabrication of Y-branches or tees and bends shall be to the angle and radius shown and the interior shall permit the smooth and even flow of liquid.
 - j. Pipe and fittings shall be furnished with an exterior coating(s) of a flexible two part coal tar epoxy waterproofing coating having a finished thickness of at least 26 mils and suitable for field repair if damaged. The waterproofing coating shall be Bitumistic 300-M as manufactured by Koppers Company, Inc. or approved equal. Coating shall be applied in accordance with the manufacturers recommendations.
 - k. Concrete pipe manufactured by the dry cast (packerhead) process is not acceptable.
4. Cast Iron Soil Pipe and Fittings
- a. Cast iron soil pipe and fittings for sanitary house connections outside the public right-of-way or on risers shall meet material requirements of ASTM A 74, service weight or heavier with leaded, mechanical, or gasketed joints.
 - b. Cast iron Pennella caps are required for all sanitary house connections and shall meet the material requirements of ASTM A 74. Use of Traffic Bearing Cleanout Cover Assembly is required in accordance with the Standard Details.
5. Ductile Iron Pipe (DIP) and Fittings and Cast Iron Fittings

- a. Ductile iron pipe (DIP) and fittings and cast iron fittings shall be as specified in Section 02551.02 except the minimum working pressure specified therein will not apply. Pipe class to be as shown on the Plans.
 - b. Ductile iron pipe and ductile iron and cast iron fittings shall be cement-lined in accordance with AWWA C 104, double thickness. This lining shall be sealed with a bituminous seal coat. The outside surfaces shall be bituminous coated.
6. Pipeline plugs shall be rubber gasketed or ribbed, watertight, airtight to the extent required by air testing requirements of this Section, cannot be dislodged by hydrostatic pressure (internal or external), and of an approved design. Plugs shall be braced in accordance with the Standard Details.
 7. Lumber for marking house connection locations shall be minimum 2-inch x 6-inch pressure treated boards of sufficient length to extend from the plug at the end of the sewer house connection to a height of 3 to 4 feet, above finished grade, and be painted green above finished grade.
 8. Transition of pipe and fitting material will not be allowed between manholes for mainline piping and/or house connections within the public right-of-way or public easements.

02561.03 EXECUTION

A. Preparation

1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250.
2. The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water.
3. No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe has been installed.
4. Each pipe shall be bedded on a solid foundation acceptable to the County. Bell holes shall be dug sufficiently large to insure that joints are properly made and the pipe is firmly bedded for the full length of the barrel.

B. Pipe Installation

1. All pipe shall be installed in accordance with the recommendations of the pipe manufacturer and as specified herein. These recommendations shall include maximum trench width, if more restrictive than that shown in the Standard Details; bedding requirements; backfill material and compaction, where applicable. In addition, the following shall apply unless otherwise noted:
 - a. Polyvinyl chloride (PVC) pipe shall be installed in accordance with the Standard Details.

- b. Reinforced concrete pipe (RCP) shall be installed in accordance with the Standard Details and the recommendations of the Concrete Pipe Association.
 - c. Ductile iron pipe (DIP) and cast iron soil pipe shall be installed in accordance with the Standard Details the recommendations of the Ductile Iron Pipe Research Association.
 2. Proper and suitable tools and appliances for safe and convenient handling and joining of pipes shall be used.
 3. Pipe shall be carefully handled and lowered into the trench. Pipe shall be installed with special care to insure that each length abuts against the next to produce no shoulder or unevenness of any kind along the inside bottom half of the pipeline. No wedging or blocking will be permitted in installing any pipe unless directed by written order or permission in writing is obtained from the County.
 4. No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Care shall be used to assure watertightness and prevent damage to, or disturbing of, the joints during the refilling process. After pipes have been installed and joints have been made, there shall be no walking on or working over the pipe, except as may be necessary in tamping the backfill material, until the backfill is at least 2 feet over the top of the pipe.
 5. The pipes shall be thoroughly cleaned before being installed and shall be kept clean until acceptance of the completed work. Open ends of all pipelines shall be provided with a stopper carefully fitted to keep dirt and other substances from entering. This stopper shall be kept in the end of the pipeline at all times when installation is not in progress.
 6. Whenever a pipe requires cutting, to fit into the line or bring it to the required location, the work shall be done in a manner that leaves a smooth, square end. Cut PVC pipe ends shall have burrs removed and the end beveled to match factory bevel. Field spigots shall be stop-marked with a felt tip marker or wax crayon for the proper length of assembly insertion.
 7. Jointing Pipe
 - a. Before any joints are made in the trench, the Contractor shall demonstrate to the County by making a sample joint that methods the Contractor will employ conform with the Specifications, will secure a watertight joint, and that the workmen whom the Contractor intends to use for this work are familiar with the requirements for making proper joints.
 - b. Other methods of jointing pipe will be given consideration by the County, provided the Contractor furnishes evidence that the proposed method is equal to or better than the specified methods, and further, provided that the proposed method has been successfully used and that the joint has previously been manufactured by the company from whom the Contractor proposes to purchase pipe.

C. Sanitary House Connections

- 1) Sanitary house connection branch fittings shall be located where designated by the County. Short pieces of sewer pipe shall be field-cut to meet this condition. The Contractor shall have available at the construction site factory approved equipment to machine and adapt the field-cut end to standard couplings and jointing materials.
- 2) Concrete for the support of Y-branches and bends shall be placed as shown in the Standard Details, or as directed.
- 3) All sewer house connections shall be installed at a 2% grade unless otherwise directed.
- 4) Sewer house connections shall be constructed to terminate at a right angle to the property line unless otherwise noted on the Plans. Ends at each lot shall terminate in a standard cleanout as shown on the Standard Detail and shall be capped, braced, and marked at ground surface by a board in accordance with Section 2561.02.C.7. Caps shall be watertight and braced so as not to be dislodged.

02561.04 METHOD OF MEASUREMENT

A. Sanitary Sewers

RESERVED FOR FUTURE USE

B. Sanitary House Connections

RESERVED FOR FUTURE USE

02561.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Sanitary Sewers

RESERVED FOR FUTURE USE

C. Sanitary House Connections

RESERVED FOR FUTURE USE

SECTION 02562

SANITARY SEWER MANHOLES

02562.01 GENERAL

A. Description

Sanitary sewer manhole installation shall include, but not necessarily be limited to, furnishing and installing County approved precast sanitary sewer manholes and miscellaneous structures of concrete or brick masonry built to the shapes and dimensions shown and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench excavation, backfill, and compaction; Section 02250.
2. Sanitary sewers; Section 02561.
3. Cast-in-place concrete; Section 03300.
4. Precast concrete utility structure installation; Section 03400.
5. Grout; Section 03600.
6. Brickwork, unit masonry; Section 04200.
7. Mortar; Section 04100.
8. Abandonment, Section 02150.

C. Quality Assurance

1. Materials

The County will inspect all materials before and after installation to ensure compliance with the Contract Drawings.

2. Field Tests

- a. Manholes and other structures will be air vacuum tested for watertightness. Testing is recommended before backfilling but shall be done after backfilling at the contractor's own risk. Acceptance testing shall be done within 1½ feet of final grade. Visual inspection after backfilling is also required. Vacuum testing shall be witnessed by the County.
- b. Manholes and other structures may be visually inspected by the County for leakage. Any visible leak shall be sealed or resealed until all leakage into the unit is satisfactorily

eliminated. Any repairs need to be made by the manufacturer. Repair methods shall be approved by the County. Infiltration testing shall be conducted only when the sewers attached to the manholes or other structures are tested in that manner. Testing shall be in accordance with Section 02561.

- c. All sanitary sewer manholes or other related structures shall be required to pass a vacuum test that is witnessed by the County. Sanitary sewer manholes/structures shall have ten (10) inches of mercury applied to the manhole and the time measured for the vacuum to drop from ten (10) inches to nine (9) inches of mercury.

All Sanitary Sewer Manhole/Structure Vacuum tests shall be performed by the contractor/developer. The contractor/developer shall provide all equipment and personnel to perform the required testing. All Sanitary Sewer Manhole/Structure Vacuum testing equipment shall be approved by the County prior to its use. Vacuum acceptance testing is to be performed after backfilling around the manhole/structure.

Vacuum testing times for sanitary sewer structures other than manholes (e.g., grease interceptors, septic/holding tanks, etc.) shall be based on the times nearest to the equivalent manhole volume or as directed by the County.

The following are minimum allowable test times for manhole/structure acceptance at the specified vacuum drop:

Depth of Manhole (feet)	Time Lapse (Seconds) Per Manhole Diameter (inches)		
	<u>48"</u>	<u>60"</u>	<u>72"</u>
8	14	18	23
10	17	23	28
12	21	28	34
14	25	32	40
16	28	37	45
18	32	41	51
20	35	46	57F
22	39	51	62
24	42	55	68
26	46	60	74
28	49	64	80
30	53	69	85

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for the following materials, and shall include the following information:

- a. Manhole-to-pipeline connectors: product description, materials identification, installation instructions including torque requirements where applicable.
- b. Flexible plastic gaskets: product description; handling, storage, installation and use information.

2. Certificates of Compliance

Certificates of compliance shall be submitted as specified in the "General Provisions" for the following:

- a. Banded-boot and compression type manhole-to-pipe connectors: stating they meet test requirements of ASTM C 923.
- b. Flexible plastic gaskets installed beneath manhole frames: stating the gasket meets test requirements of AASHTO M 198.

02562.02 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for sanitary sewer manholes.

B. Contractor's Options

1. The Contractor may furnish aluminum or plastic-coated steel for manhole steps.
2. The Contractor may furnish precast, cast-in-place, or masonry construction for miscellaneous sanitary sewer structures, unless otherwise noted.
3. The Contractor may furnish mechanically wedged-in-place, cast-in-place banded-boot, or cast-in-place compression type connectors for manhole-to-pipeline connections, where slope of the pipeline is 10% or less.

C. Detailed Material Requirements

1. Granular bedding beneath manhole bases shall meet the gradation requirements of AASHTO M43, size number 57, as specified in Section 02621.
2. Portland cement concrete for cast-in-place structures shall be as specified in Section 03310.02, Mix Number as indicated on the Standard Details or the Plans.
3. Precast manhole bases, risers, cone sections, grade rings, and precast utility structures shall be as specified in Section 03400.
4. Joints shall be "0" ring compression type meeting the requirements of ASTM C-443 or County approved equal.

5. Quick-setting non-shrink grout shall be as specified in Section 03600.
6. Mortar for brickwork and grade rings shall be as specified in Section 04100.
7. Brick for manhole inverts and miscellaneous structures shall be sewer brick as specified in Section 04200.02.
8. Curing compound shall meet the requirements of ASTM C 309, Type 2, white pigmented and shall be Scotch Kure resin base, Type II, Class B, or County approved equal.
9. Frames, covers, and steps shall be as specified in Section 05500. Covers shall be labeled in accordance with the Standard Details. Frames and covers shall be factory coated with a coal tar paint meeting the requirements of Federal Military Specification MIL-C-18480A. Steps shall be as dimensioned in the Standard Details.
10. Waterproofing for exterior of manholes and miscellaneous structures shall be as specified in Section 07100.02.
11. Interior manhole amined-cured high solids epoxy coating shall be Series 61 Tneme-liner by Tnemec Co., Inc. or County approved equal.
12. Manhole-to-Pipeline Connectors
 - a. Water-stop type connectors shall be only used when slope of the connecting pipeline is greater than 10%. Water-stop type connections shall be the Water-Stop Ring as manufactured by Certain Teed; Type CMA Adapter as manufactured by Fernco, Inc.; or County approved equal.
 - b. Mechanically wedge-in-place type connectors shall be Link-Seal as manufactured by the Thunderline Corp; Z-Lok XP as manufactured by A-Lok Products, Inc.; Kor-N-Seal as manufactured by National Pollution Control Systems, Inc.; or County approved equal.
 - c. Cast-in-place type connectors shall be:
 - 1) Banded-boot type: Z-Lok as manufactured by A-Lok Products, Inc.; the L. J. Flexible Sleeve as manufactured by GHA Lock Joint, Inc.; or County approved equal.
 - 2) Compression type: A-Lok as manufactured by A-Lok Products, Inc.; or County approved equal.
13. Flexible plastic gaskets between the manhole or grade rings and the manhole frame shall be extruded rope, type B, 3/4 inch minimum diameter, butyl based, meeting requirements of AASHTO M 198 as manufactured by Hamilton Kent Mfg. Kent Co., Seal No. 2; Concrete Products Supply Company, E-2 Stik; ADCO Products, ST-30 Flex-Lok; or County approved equal.
14. Bentonite shall be in granular form as specified in Section 07130.02 for waterproofing at pipe penetrations.

15. Transition manholes shall be polymer concrete manholes or thermalplastic lined. Polymer concrete manholes shall be manufactured by U.S. Composite Pipe, Inc., Geneva Polymer Products, or County approved equal.
16. Fiberglass witness post – for manholes in cross country rights of way/easements. Fiberglass posts to extend 5 feet above the top of manhole; posts to be reflective and identified as Sewer (orange posts with black lettering). Marker to be placed on upstream side of manhole, facing forward up the right of way, embedded two feet into the ground.

02562.03 EXECUTION

A. General

1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
2. Manholes and drop connections shall be installed in accordance with the Standard Details and as specified herein.
3. Miscellaneous structures shall be constructed where shown and as indicated on the Plans or as directed by the County.
 - a. Cast-in-place concrete construction shall be as specified in Section 03300.03.
 - b. Brick construction shall be as specified in Section 04200.03.
4. Reinforced concrete, ductile iron and cast iron pipelines connected to manholes and other structures shall have a pipe joint not more than 2 feet from the exterior wall of the structure.

B. Manhole Installation

1. Manholes shall be installed and frames and covers set as pipeline installation progresses. The manhole vertical axis shall be plumb and directly over the centerline of the pipeline unless otherwise shown or directed.
2. Manholes shall be watertight. Exteriors shall be coated with waterproofing in accordance with Section 07100.03 and in accordance with the manufacturer's recommendations.
3. Channels for receiving and passing water shall be formed in the bottom of manholes as shown or directed. All such channels shall be lined with brick, brick and split vitrified pipe, or precast concrete channels as manufactured by Atlantic Concrete Products, Inc. Channels shall slope smoothly and evenly and a channel bench constructed to the height of the crown of the highest pipe. Channels and a 2 foot length of pipe with a watertight plug shall be installed in the manhole for future extensions where shown on the Plans or directed by the County. For manholes constructed with thermoplastic liners, liner sheets or panels shall be field cut and shaped to fit the floor and channels of the manhole. Concrete for the floor and channels shall be

poured through openings cut in the thermoplastic liner so that the liner anchors are cast integrally with the floor and channel concrete.

4. Pipes shall be cut flush with the inside wall of the manhole. Exterior of pipe penetration shall be waterproofed in accordance with 07130.03. For manholes constructed with thermoplastic liners, the liner sheets or panels shall have their seams welded in accordance with the plastic manufacturer's instructions only after all concrete has thoroughly dried. Seams around pipe penetrations shall be sealed with a caulk type sealant compatible with the liner material as recommended by the liner manufacturer. Openings in the floor liner used for pouring the concrete floor and channel shall be patched and welded in accordance with the liner manufacturer's instructions.
5. The frame and cover shall be installed in accordance with the Standard Details.
 - a. Obtain proper grade by using a minimum of 1 2, 3, 4 or 6 inch thick grade ring and a maximum combination of rings not to exceed a total of 12". The grade rings shall be set in full beds of mortar not less than 1/4 nor more than 1 1/4-inches thick. Anchor boltholes shall be packed tight with mortar, with the mortar in the holes of the top ring finished flush with the ring surface. All horizontal, circumferential, and vertical mortar joints inside and outside of the structure shall be pointed for their full width. Depth of pointing shall not exceed 3/8 inch. Mortar mix shall include a bonding agent in accordance with Section 04100 of these specifications. The limit of application of mortar mix shall be consistent with manufacturer's recommendations.

Manholes shall have frame anchored to manhole with anchor bolts in accordance with the Standard Details.

- b. The newly installed grade ring transition section shall be completely coated on the inside, top, and outside with curing compounds, overlapping a minimum of 6 inches down on the manhole structure. The curing compound shall be applied within 3 hours after the mortar placement. Transition by parging overhang joint between ring and manhole structure, inside and outside of manholes, and apply curing compound. Cure entire grade ring transition section for a minimum of 24 hours prior to setting manhole frame and cover and backfilling.
- c. Install frame and cover set flush with existing surfaces, to new elevations shown on the Plans or as directed by the County, all in accordance with Standard Details. For existing manholes, provide anchor bolts by drilling into the existing manhole wall and provide a neoprene gasket between the frame and manhole structure.
- d. Water tight bolt down manhole frames and covers shall be used in all non-paved utility rights of ways, easements where inflow may present a problem, and where indicated on the approved plans. Vented bolt down manhole frames and covers shall be used in all non-paved utility rights of ways, easements, and where indicated on the approved plans.

In non-paved and non-maintained areas the top of the pre-cast manhole shall extend twenty four inches above the proposed finished grade or the 100-year flood plain elevation, whichever is higher. The frame and cover shall be painted with two coats of safety yellow lead free industrial enamel paint as manufactured by Duron or County approved equal.

6. All manholes (existing and new) receiving flows from sewage force mains or low pressure sewers shall receive an interior coating system of amine-cured high solids epoxy. Application shall be in accordance with the manufacturer's recommendations and as specified below.
 - a. Surface preparation - Provide brush-off abrasive blast cleaning to remove loose surface concrete and contaminants and provide "tooth" for good coating adhesion. Repair all interior surface imperfections with epoxy mortar in accordance with the manufacturer's recommendations. Remove all dust from surface to receive the interior coating. All concrete surfaces shall be dry.
 - b. First coat - Amine-cured high solids epoxy. Thin a maximum of 10% using only thinners specified by the coating manufacturer and apply to prepared surface via brush, air spray, airless spray, or as allowed by the coating manufacturer. Apply at a rate which results in a thickness of 8.0 to 12.0 dry mils.
 - c. Second coat - Amine-cured high solids epoxy. Apply un-thinned coating at a rate which results in a thickness of 8.0 to 12.0 dry mils. Observe the manufacturer's recommended recoat time. The first coat shall be a lighter color than the second coat. The total dry film thickness shall be 16.0 to 24.0 mils. All manufacturer's instructions shall be strictly followed.

02562.04 METHOD OF MEASUREMENT

A. Sanitary Sewer Manholes

RESERVED FOR FUTURE USE

B. Drop Connections

RESERVED FOR FUTURE USE

C. Miscellaneous Structures

RESERVED FOR FUTURE USE

02562.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Sanitary Sewer Manholes

RESERVED FOR FUTURE USE

C. Manhole Drop Connections

RESERVED FOR FUTURE USE

D. Miscellaneous Structures

RESERVED FOR FUTURE USE

E. Waterproofing

RESERVED FOR FUTURE

SECTION 02563

SANITARY SEWER FORCE MAINS

02563.01 GENERAL

A. Description

Sanitary sewer force main installation shall include, but not necessarily be limited to, furnishing and installing pressure rated pipe, fittings, and appurtenances of size and type shown on the Plans, installed on firm foundation true to line and grade and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Protection of the environment; Section 01500.
2. Trench excavation, backfill, and compaction; Section 02250.
3. Excavation Support; Section 02400
4. Dewatering; Section 02512
5. Precast concrete utility structures; Section 03400.
6. Abandonment, Section 02150.

C. Quality Assurance

1. Materials

The County will inspect all materials before and after installation to ensure compliance with the Contract Documents.

2. Field Tests

a. General

- 1) After installation, force mains will be initially inspected by the County and shall be Contractor tested for compliance with these Specifications. Initial inspections and tests will not be conducted until at least 48 hours after all concrete thrust blocks and anchors have been constructed and backfilling completed on the section of force main being tested. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the specified tests. The contractor/his supplier shall demonstrate that all sewage air release valves, combo sewage air valves and sewage air vacuum valves are fully functional and in proper working order prior to acceptance.

- 2) The force main and appurtenances shall be tested in accordance with Section 02551.01, Article C except as modified herein.
- 3) Chlorination will not be required.
- 4) The Contractor shall schedule all tests with the County at least 48 hours in advance of the test, and shall conduct all acceptance testing in the presence of the County. The County will witness one test and perform one Substantial Completion Inspection and one Final Inspection at no cost to the Contractor. If the project is released for service following Substantial Completion acceptance tests, the County will perform a final inspection if required at no cost to the Contractor. Should the pipeline fail the first County witnessed test, the Contractor shall reimburse the County for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the County for the cost of inspection if the Contractor is not prepared for any test, additional retests, and additional Substantial Completions including Partial Substantial Completion Inspections or additional Final Inspections. Reimbursement shall be made prior to the next Substantial Completion or Final Inspection.
- 5) Generally force mains will be tested from end to end. Pressure and leakage tests shall be performed.
- 6) If the force main or any section or component thereof fails the tests and/or inspection, the Contractor shall, at the Contractor's own expense, repair or replace any defective component and retest the entire force main until all requirements are met. Should the work be done by the County in the case of an emergency, the Contractor shall reimburse the County for the actual cost of replacing such materials and making such installations.
- 7) Hydrostatic pressure testing shall be required in accordance with Section 02551.01.C.2.c.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for the following materials, and include the following information:

- a. Plug valves and appurtenances: product description, pressure rating, parts list, detailed assembly drawings, and maintenance requirements and procedures.
- b. Sewage air release and combination air/vacuum valves and appurtenances: product description, pressure rating, parts list, detailed assembly drawings, and maintenance requirements and procedures.

2. Certificates of Compliance

Certificates of compliance shall be submitted as specified in the "General Provisions" for pipe and fittings stating the item supplied is in accordance with requirements specified in Section 02551, "Water Mains."

02563.02 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for sanitary sewer force mains.
2. The Contractor may obtain potable water from the County's potable water system for testing the low pressure sewer system. The Contractor shall contact the Department of Fiscal Services, Billing Section, for requirements. A backflow prevention device must be placed in accordance with the Standard Details prior to drawing County water.

B. Contractor's Options

The Contractor shall furnish ductile iron pipe for sanitary sewer force mains unless otherwise noted. Ductile or cast iron fittings shall be furnished for use with ductile iron pipe.

C. Detailed Material Requirements

1. Washed gravel for air release and vacuum valve manhole fill shall meet the gradation requirements of AASHTO M43, size number 57, as specified in Section 02621.02.
2. Portland cement concrete for pipe buttresses and anchorages shall be Mix No. 1 as specified in Section 03310.02.
3. Ductile iron pipe and fittings shall be as specified in Section 02551.02. Pressure rating or class shall be as noted in the Contract Documents. Double cement lining and coatings shall be required on ductile iron pipe (DIP) and fittings.
4. Valves
 - a. Resilient Seat Gate Valves

Utilize Resilient Seat Gate Valves per material requirements in Section 02552.02. Approved valve shall be U.S. Pipe Metroseal 250 or County approved equal.
5. Valve boxes shall be as specified in Section 02552.02 except the covers shall be labeled "SEWER."
6. Sewage Air-Vacuum Valves
 - a. Sewage Air-Vacuum Valves shall allow unrestricted venting or re-entry of air through the valve body during filling or draining of the forcemain. The valve shall automatically open to prevent the formation of a vacuum within the pipeline.

- b. Sewage Air-Vacuum Valves shall have either a stainless steel or epoxy coated cast iron body. The valve shall incorporate either a solid polypropylene and stainless steel or polycarbonate float not hard connected to one another utilizing a "rolling seal" mechanism. The internal mechanism rolling seal shall be EDPM and all other internals shall use non-corrosive material to avoid galvanic action. The float shall withstand a minimum pressure of 1000 psi. Working pressure is to be 3 – 230 psi.
- c. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

PART	MATERIAL	SPECIFICATION
Body & cover & baffle	Stainless Steel or Epoxy Coated Cast Iron	Type 316 NSF 61 Certified
Upper Float	Foamed Polypropylene	NSF 61 Certified
Lower Float	Stainless Steel Polycarbonate	ASTM A240 T304 NSF 61 Certified
Stem, Guide Bushings	Stainless Steel	Type 316
Seat/Rolling Seal	EDPM	NSF 61 Certified
Exterior Paint	Stainless Steel Epoxy Coated	NSF 61 Certified

- d. An isolating valve shall be installed between the forcemain and air release valve. The valve shall be a plug valve meeting the requirements of paragraph C.4 of Section 02563.02.

Plug isolation valves shall be equipped with gear actuators and adapters for 2-inch operating nuts. The valve shall also be equipped with an extension stem bringing the operating nut to within 12-inches of the ground surface. The installation shall meet the requirements of paragraph C.4 of Section 02563.02.

- e. Sewage air vacuum valves shall be installed in easily accessible pre-cast manhole vaults. The vault shall be sized to properly house the valve assembly as well as providing sufficient lateral and vertical clearances to facilitate valve removal and maintenance.

Where possible, the vault shall be drained to an adjacent sanitary manhole.

Vaults shall be adequately vented to meet air release valve requirements.

- f. All internals shall be easily removed through the top cover without removing the valve body from the forcemain.

- g. Valve shall be Models K-020 Epoxy Body or Model K-020SS, Stainless Steel Body as manufactured by ARI Flow Control Accessories, or approved equal.

7. Sewage Air Release Valves

- a. Sewage air release valves shall be of the type designed to operate while the pipeline is in service (under pressure) and shall automatically release pressurized air, gas, or vapor through the orifice without spillage or spurt.
- b. Sewage air release valves shall have either a stainless steel or reinforced nylon body. The valve shall incorporate either a solid polypropylene and stainless steel or polycarbonate float not hard connected to one another utilizing a "rolling seal" mechanism. The internal mechanism rolling seal shall be stainless steel or EDPM, and all other internals shall use non-corrosive material to avoid galvanic action. The float shall withstand a minimum pressure of 1000 psi.
- c. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

PART	MATERIAL	SPECIFICATION
Body & cover	Stainless Steel Reinforced Nylon	Type 304 NSF 61 Certified
Float	Polypropylene Stainless Steel Polycarbonate	NSF 61 Certified ASTM A240 T304/316 NSF 61 Certified
Stem, Guide Bushings	Stainless Steel	ASTM A240 T304/316
Seat/Rolling Seal	EDPM	NSF 61 Certified
Exterior Paint	Reinforced Nylon Stainless Steel	NSF 61 Certified Type 304

- d. The valve manufacturer shall furnish installation and maintenance manuals with each valve.
- e. An isolating valve shall be installed between the forcemain and air release valve. The valve shall be a plug valve meeting the requirements of paragraph C.4 of Section 02563.02.
- f. Sewage air release valves shall be installed in easily accessible pre-cast manhole vaults. The vault shall be sized to properly house the valve assembly as well as providing sufficient lateral and vertical clearances to facilitate valve removal and maintenance.

Where possible, the vault shall be drained to an adjacent sanitary manhole.

Vaults shall be adequately vented to meet air release valve requirements.

- g. All internals shall be easily removed through the top cover without removing the valve body from the forcemain.
- h. Valve shall be Models D-025TNR Nylon Body, or Model S-020SS Stainless Steel Body as manufactured by ARI Flow Control Accessories, or approved equal.

8. Combination Sewage Air Valves

- a. Combination sewage air valves shall be of the single body, double orifice design. The combination valve shall allow large volumes of air to escape or re-enter the force main through the large orifice during filling or draining of the line. While the main is under pressure, the combination valve shall automatically release pressurized air, gas or vapor through the small orifice without spillage. The small and large orifices shall act independently of each other.
- b. The sewage combination air valve shall have either a stainless steel or reinforced nylon body. The valve shall incorporate either a solid polypropylene and stainless steel or polycarbonate float not hard connected to one another utilizing a "rolling seal" mechanism. The internal mechanism rolling seal shall be stainless steel or EDPM, and all other internals shall use non-corrosive material to avoid galvanic action. The float shall withstand a minimum pressure of 1000 psi.
- c. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

PART	MATERIAL	SPECIFICATION
Body & Cover	Stainless Steel Reinforced Nylon	Type 316 NSF 61 Certified
Float	Foamed Polypropylene Stainless Steel Polycarbonate	NSF 61 Certified ASTM A240 T304 NSF 61 Certified
Stem, Guide Bushings	Stainless Steel	ASTM A240 T304
Seat/Rolling Seal	EDPM	NSF 61 Certified
Exterior Paint	Reinforced Nylon Stainless Steel	NSF 61 Certified Type 304

- d. The valve manufacturer shall furnish installation and maintenance manuals with each valve.
- e. An isolating valve shall be installed between the force main and combination sewage air valve. The valve shall be a plug valve meeting the requirements of paragraph C.4 of Section 02563.02.

Plug isolation valves shall be equipped with gear actuators and adapters for 2-inch operating nuts. The valve shall also be equipped with an extension stem bringing the operating nut to within 12-inches of the ground surface. The installation shall meet the requirements of paragraph C.4 of Section 02563.02.

- f. Combination sewage air valves shall be installed in easily accessible pre-cast manhole vaults. The vault shall be sized to properly house the valve assembly as well as providing sufficient lateral and vertical clearances to facilitate valve removal and maintenance.

Where possible, the vault shall be drained to an adjacent sanitary manhole.

Vaults shall be adequately vented to meet air release valve requirements.

- g. Valve shall be Models D-025 Nylon Body, or Model D-020SS Stainless Steel Body as manufactured by ARI Flow Control Accessories, or approved equal.

02563.03 EXECUTION

- A. Trench excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
- B. Force main installation shall be as specified in Section 02551, "Water Mains," except chlorination is not required.
- C. Pipe bedding, thrust and anchor blocks, and force main appurtenances shall be installed in accordance with the Standard Details for Water.
- D. Valves
 1. Resilient Seat Gate Valves installation shall be as specified in Section 02552.03.
- E. Sewage air release and combination air release/vacuum valves shall be installed in accordance with the Standard Details for Sewage.

02563.04 METHOD OF MEASUREMENT

- A. Force Main

RESERVED FOR FUTURE USE

- B. Isolation, Sewage Air Release and Combination Air/Vacuum Valves

RESERVED FOR FUTURE USE

02563.05 BASIS OF PAYMENT

- A. General

RESERVED FOR FUTURE USE

B. Force Main

RESERVED FOR FUTURE USE

C. Isolation, Sewage Air Release and Combination Air/Vacuum Valves

RESERVED FOR FUTURE USE

SECTION 02564

CONNECTIONS TO EXISTING SANITARY SEWER FACILITIES

02564.01 GENERAL

A. Description

Connections to existing sanitary sewer facilities shall include, but not necessarily be limited to, all work necessary to make connections of new sanitary sewers to existing manholes and to connect new sanitary house connections to existing sanitary sewers, complete in place, in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench excavation, backfill, and compaction; Section 02250.
2. Sanitary sewers and sanitary house connection installation; Section 02561.
3. Sanitary sewer manhole installation; Section 02562.

C. Quality Assurance

1. Materials

The County will inspect all materials before and after installation to ensure compliance with the Contract Documents.

2. Field Tests

No testing will be conducted on manhole or sanitary house connections installed in accordance with this Section, however, the work will be visually inspected for conditional acceptance and for final acceptance. Should this inspection discover any defects at the manhole or the sewer at the connection points, the Contractor shall take such actions and make repairs in accordance with the connector manufacturer's written recommendations, as approved by the County, to stop the leakage. No connection shall be backfilled until approved by the County.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for the following materials, and include the following information:

- a. Manhole-to-pipe connectors: product description, materials identification, installation instructions including torque requirements where applicable.

- b. Stainless steel or bronze/brass saddle assemblies: product description, materials identification, installation instructions including torque requirements where applicable.
2. Certificates of compliance shall be submitted as specified in the "General Provisions" for banded-boot and compression type manhole-to-pipe connectors: stating they meet requirements of ASTM C 923, "Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes".

02564.02 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for connections to existing facilities.

B. Contractor's Options

1. The Contractor may furnish mechanically wedged-in-place, grouted-in-place sleeve, or grouted-in-place water-stop type connections for manhole-to-pipe connections, unless otherwise noted.
2. The Contractor may furnish stainless steel or bronze/brass saddles for use on polyvinyl chloride (PVC) sewer mains.

C. Detailed Material Requirements

1. Portland cement concrete for pipe encasement shall be Mix No. 1 as specified in Section 03310.
2. Quick-setting, non-shrink grout shall be as specified in Section 03600.
3. Mortar for brickwork shall be as specified in Section 04100.02.
4. Brick for manhole inverts shall be sewer brick as specified in Section 04200.02.
5. Existing Manhole Connections
 - a. Mechanically wedged-in-place type connectors shall be Kor-n-Seal as manufactured by National Pollution Control Systems, Inc., or County approved equal.
 - b. Grouted-in-place sleeve type connectors shall be Z-Lok Repair Sleeve manufactured by Atlantic Concrete Products Co., Type CT manhole adapter as manufactured by Certain Teed, or County approved equal.
 - c. Grouted-in-place water-stop type connectors shall be Water Stop Ring as manufactured by Certain Teed, Type CMA Adaptor or large diameter waterstops as manufactured by Fernco., Inc. or County approved equal.
 - d. All metal fasteners (bolts, nuts, etc.) shall be Type 304 stainless steel.
6. House Connection Saddles

- a. All house connection saddles shall be specifically designed for the pipe material to which they are to be attached.
 - b. Saddles shall be stainless steel or bronze/brass with; Type 304 stainless steel straps, T-bolts, nuts, and washers; and resilient gaskets. Spot welds for strap fabrication shall be fully passivated. The resilient gasket shall be permanently attached to the saddle body to prevent its displacement during installation or shall be of a design that will permit easy visual verification that the gasket is in place. The assembly shall have an integral stop to prevent house connection pipes from protruding into the sewer.
 - c. Metal saddles shall be the Sealtite Sewer Pipe Saddles as manufactured by the General Engineering Company; Style CB Sewer Saddle as manufactured by Romac Industries, Inc.; or County approved equal.
7. Bentonite shall be in granular form as specified in Section 07130.02.

02564.03 EXECUTION

A. General

1. Trench excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
2. Connections to existing facilities shall be in accordance with the connector manufacturers written recommendations, the Standard Details, and as specified.

B. Manhole Connections

1. Holes for installing new pipes in existing manholes shall be carefully cored, drilled, or cut in such a manner to minimize damage to the manhole. Any damage to the existing manhole structure shall be promptly repaired to the satisfaction of the County or the manhole replaced. Reinforcing steel in precast manholes shall be cut only to the extent necessary to accommodate the new pipe and seal system.
2. The new pipe and connector shall be roughly centered in the hole and the pipe end set flush with the inside wall of the manhole.
3. The pipe and connector shall be encased in a 100% bentonite collar for a distance of 6 inches beyond the end of the connector and extending at least 6 inches all around the connecting pipe.
4. The manhole channel shall be reconstructed as necessary to accommodate the new pipe connection in accordance with Section 02562.03.

C. House Connection Saddles

1. The sanitary sewer shall be uncovered, cleaned, and inspected at the location of the proposed sewer house connection. The saddle shall not be installed where surface imperfections in the

main will prevent the saddle gasket from making a watertight seal or within 1 foot of a mainline pipe joint.

2. The saddle shall be attached to the sewer and the strap tightened to the appropriate torque and in accordance with the manufacturer's recommendations.
3. The sewer shall be cut using a tapping or cutting machine of suitable design, and the "coupon" removed.

D. New House Connection Tees or Wyes

1. Whenever a saddle cannot be installed in an existing pipeline in accordance with Paragraph C above, a new wye or tee fitting of proper size shall be inserted into the existing pipeline.
2. The existing sanitary sewer shall be fully exposed for the portion to be removed and the sewer pipe power-saw-cut to a flat face perpendicular to the centerline of the pipe and removed to limits of the fitting or as directed by the County, and a new fitting and/or sections of pipe installed in its place. Particular care shall be given to insure the slope and invert of the new fitting matches the existing line by careful reshaping of the trench bottom.
3. The new fitting shall be installed and connected to the existing pipe with full circle, transition (if required), stainless steel and rubber gasketed coupling and/or repair sleeves and stainless steel clamps.

02564.04 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

02564.05 BASIS OF PAYMENT

RESERVED FOR FUTURE USE

SECTION 02565

SANITARY SEWER REHABILITATION

02565.01 GENERAL

A. Description

Sanitary sewer rehabilitation shall include, but not necessarily be limited to, sewer pipe cleaning, sewer flow control, television inspection, sewer pipe joint testing, sewer pipe joint sealing, sewer manhole sealing, sewer manhole rehabilitation, sewer manhole lining, slip-lining, cured-in-place pipe lining, pipe and fitting replacement, and sewer manhole replacement in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Protection of environment; Section 01500.
2. Structure excavation; Section 02220.
3. Trench excavation, backfill, and compaction; Section 02250.
4. Sanitary sewer and sanitary sewer house connection installation; Section 02561.
5. Sanitary sewer manhole installation; Section 02562.
6. Sanitary sewer force main; Section 02563.
7. Connections to existing sanitary sewer facilities; Section 02564.

C. Quality Assurance

1. Materials
 - a. The County will inspect all materials before and after installation to ensure compliance with the Contract Documents.
 - b. Special grouts, sealers, and coating systems shall be delivered to the site in the manufacturer's sealed, labeled, and dated containers. Storing and handling materials shall be in strict accordance with the manufacturer's instructions. Failure to properly store and handle material will result in rejection of material for use. Materials beyond the expiration date indicating the manufacturer's recommended shelf life will not be permitted to be used. A freezing weather limitation of 32 degrees will be enforced.
 - c. Cured-in-place lining materials shall be chemically stable and resistant to concentrations of acids, alkalis, and organics found in sewage. The materials may be delivered to the site in either separate or pre-wetted fabrications in transportation containers designed to protect

the integrity of the resin, catalyst, and liner. The time of resin and catalyst mixing will be recorded at the location of liner "wetting". Special handling instructions such as minimum or maximum temperature to be maintained during transportation and installation will also be recorded. Liners "wetted" for a time interval which exceeds the resin manufacturer's specified "pot life" at the recommended temperature will not be permitted to be used. Any evidence of setting before installation will result in rejection of material.

2. Field Testing

a. General

- 1) After the item in question has been rehabilitated or replaced, it will be inspected by the County and, if required herein, shall be Contractor tested for compliance with these Specifications. The Contractor shall furnish all labor, tools, materials, and equipment (except water as provided for in Section 02563.02, and timers which will be furnished by the County) necessary to perform the specified tests.
- 2) The Contractor shall schedule all tests with the County at least 48 hours in advance of the test, and shall conduct all acceptance testing in the presence of the County. The County will witness one test and perform one Substantial Completion Inspection and one Final Inspection at no cost to the Contractor. If the project is released for service following Substantial Completion acceptance tests, the County will perform a final inspection if required at no cost to the Contractor. Should the pipeline fail the first County witnessed test, the Contractor shall reimburse the County for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the County for the cost of inspection if the Contractor is not prepared for any test, additional retests, and additional Substantial Completions including Partial Substantial Completion Inspections or additional Final Inspections. Reimbursement shall be made prior to the next Substantial Completion or Final Inspection.
- 3) If the item in question fails the test specified and/or inspection, the Contractor shall, at the Contractor's own expense repair or replace any defective component in accordance with the manufacturer's recommendations and retest or have the County reinspect the item until all requirements are met. Should any work be done by the County in the case of an emergency, the Contractor shall reimburse the County for the actual cost of replacing such materials and making such installations.

b. Sewer Cleaning

- 1) After completion of sewer pipeline cleaning, the County will visually, or by closed circuit television camera, inspect in whole or part the pipe system for which the cleaning task has been completed. Evidence of significant remaining sediment, debris accumulation, or root intrusion will result in rejection of the pipe system. The Contractor shall reperform the Contractor's cleaning operation and retest the line until the sewer is satisfactorily cleared of sediment, debris, grease, and roots.

- 2) In areas where television inspection is not performed, the County may require the Contractor to pull a double squeegee (with each squeegee the same diameter as the sewer), or propel a "GO/NO GO" ball through each section of pipeline cleaned as evidence of adequate cleaning.
- 3) Force mains will be accepted when they can pass a sewer ball which has a diameter of at least 95% of the line being cleaned.

c. Manhole Sealing and Rehabilitation

After manhole rehabilitation procedures have been performed, the manholes will be visually inspected by the County for leakage. Any leak or seepage which produces a visible trickle or stream will be cause for rejection of the work.

d. Gravity Sewer Pipe

- 1) Slip-lined Pipe: After installation, but before any house connections are reinstated, the liner pipe shall be low-pressure air tested by the Contractor in accordance with the procedures specified in Section 02561.01.
- 2) Cured-in-Place Pipe Lining: After installation procedures have been performed and curing complete, but before any house connections are reinstated, the pipeline shall be hydrostatically tested by the Contractor.
 - a. The test shall be conducted by using the existing hydrostatic head provided by the inversion standpipe providing this head is at least 7 feet above the prevailing groundwater elevation. The test time shall be 1 hour during which time no makeup water shall be added to the standpipe. If, at the end of the test period, no water loss is observed in the standpipe, the cured-in-place pipe will be accepted.
 - b. If water loss is observed in the standpipe, the lining will fail the test.

e. Force Mains

- 1) After installation procedures have been performed for either slip-lined or cured-in-place pipe lining, the lined force main shall be hydrostatically tested by the Contractor.
- 2) The completed liner shall be filled with water to eliminate all air and brought to the test gradient or pressure as indicated in the Contract Documents.
- 3) After the system has been pressurized to the test pressure and the pumps disconnected, the liner shall hold the test pressure with no visible drop in pressure for 1 hour. Testing pressures and criteria shall be similar to water main hydrostatic testing in accordance with Section 02551.C.2.c.

D. Submittals

1. Shop Drawings

- a. Shop drawings shall be submitted as specified in the "General Provisions" for all materials other than those furnished by the County. The Contractor shall submit product information and detailed manufacturer's recommendations and instruction on the storage, handling, mixing (where appropriate), and installation of all materials intended to be used for rehabilitation.
 - b. For those materials which rely on chemical reactions and/or heat (energy) sources to obtain a "cure" of the materials, details shall be submitted indicating "pot life" after mixing; curing time; temperature limitations during transportation, application, and installation; and special handling requirements.
2. Certificates of Compliance
- a. Certificates of compliance shall be submitted as specified in the "General Provisions" for materials listed in Section 02565.02 when indicated in the paragraph where the materials are specified.
 - b. Certificates of compliance shall be submitted for glass fiber-reinforced polyester manholes, polyethylene pipe, and reinforced plastic mortar pipe indicating the item supplied is in accordance with the referenced standard.

02565.02 MATERIALS

A. Materials Furnished by the County

Unless otherwise noted in the "Special Provisions" for the Department of Planning and Growth Management, the County will make available for one test only water from its potable water system to the Contractor at no charge.

B. Contractor's Options

1. The Contractor may furnish and install, unless otherwise noted, Polyethylene (PE), Reinforced Plastic Mortar (RPM), or cured-in-place liners, for lining existing gravity pipelines.
2. The Contractor may furnish and install Polyethylene (PE) or cured-in-place liners for lining existing force mains.

C. Detailed Material Requirements

1. Portland cement concrete for pipe encasement shall be Mix No. 1 as specified in Section 03310.
2. Quick-setting, non-shrink grout shall be as specified in Section 03600.
3. Chemical Sealing Materials
 - a. General

- 1) The intent of this Item is to define the properties a sealing material shall have to perform effectively in the intended application and under expected field conditions.
 - 2) Generic chemical sealing materials currently used are listed with the basic properties, performance standards, and mix ratios which have previously given acceptable performance.
 - 3) It is recognized that new and improved chemical sealing materials may become available. Sources, manufacturers, and product names of chemical sealing materials will change and therefore specific sources, manufacturers, and product names are not referred to in this Specification.
 - 4) Sealing materials shall contain a root inhibitor.
- b. All chemical sealing materials used in performance of the work specified shall have the following properties and characteristics:
- 1) While being injected, the chemical sealant shall be able to react/perform in the presence of water.
 - 2) The cured material shall be capable of withstanding submergence in water without degradation.
 - 3) The resultant sealant formation shall prevent passage of water.
 - 4) The sealant, after curing, shall be flexible as opposed to brittle or rigid.
 - 5) In place, the resultant sealant formation shall be able to withstand freeze/thaw and wet/dry cycles without adversely affecting the seal.
 - 6) The sealant formation shall not be biodegradable. Additives may be used to meet this requirement.
 - 7) The cured sealant shall be chemically stable and resistant to concentrations of acids, alkalis, and organics found in sewage.
 - 8) Packaging of component materials shall be compatible with field storage and handling requirements. Packaging shall provide for worker safety and minimize spillage during handling.
 - 9) Mixing of component materials shall be compatible with field operations and not require precise measurements.
 - 10) Cleanup shall be done without excessive use of flammable or hazardous chemicals.
 - 11) Residual sealing materials shall be removable from the sewer after injection to insure no flow reduction, restriction, or blockage of sewage flows.

- c. Acrylamide base gel chemical sealing material requirements, properties, and characteristics:
- 1) A minimum of 10% acrylamide base material by weight in the total sealant mix. A higher concentration (%) of acrylamide base material may be used, when desirable, to increase strength or offset dilution during the induction period.
 - 2) The ability to tolerate some dilution and react in moving water during the induction period.
 - 3) A viscosity of approximately 2 centipoise which can be increased with additives.
 - 4) A constant viscosity during the induction period.
 - 5) A controllable reaction time (induction period) from 10 seconds to 1 hour.
 - 6) A reaction (curing) which produces homogeneous, chemically stable, nonbiodegradable, firm, flexible gel.
 - 7) The ability to increase mix viscosity, density, and gel strength by use of additives, e.g.: diatomaceous earth.
- d. Acrylate base gel chemical sealing material requirements, properties, and characteristics:
- 1) A minimum of 10%* acrylate base material by weight in the total sealant mix. A higher concentration (%) of acrylate base material may be used, when desirable, to increase strength or offset dilution during the induction period.

*Note: If the acrylate base material is in a 40 solution, it shall comprise 25% by weight of the total sealant mix to have 10% base material.
 - 2) A low toxicity of the acrylate base material, i.e.: acute oral toxicity in rats (LD50) of 5000 mg/kg body weight of rats.
 - 3) The ability to tolerate some dilution and react in moving water during the induction period.
 - 4) A viscosity of approximately 2 centipoise which can be increased with additives.
 - 5) An essentially constant viscosity during the induction period.
 - 6) A controllable reaction time (induction period) from 10 seconds to 1 hour.
 - 7) A reaction (curing) which produces homogeneous, chemically stable, nonbiodegradable, firm, flexible gel.
 - 8) The ability to increase mix viscosity, density, and gel strength by the use of additives, e.g.: diatomaceous earth.

- e. Urethane base foam chemical sealing material requirements, properties, and characteristics:
- 1) Approximately 1 part of urethane prepolymer thoroughly mixed with 1 part of water by weight (50% prepolymer).
 - 2) A liquid prepolymer having a solids content of 82% to 88%, specific gravity of 1.1 (9.15 pounds per gallon), and flash point of 20oF.
 - 3) A liquid prepolymer having a viscosity of 300 to 500 centipoise at 72oF that can be pumped through 500 feet of 1/2-inch hose with a 500 psi head at a 1 ounce/second flow rate.
 - 4) A cure time of 15 minutes at 40oF, 8.2 minutes at 70oF, and 4.6 minutes at 100oF when the prepolymer is reacted with water only.
 - 5) A cure time of 15 minutes at 40oF, 3.5 minutes at 70oF, and 2.6 minutes at 100oF when the prepolymer is reacted with water containing 0.4% accelerator.
 - 6) During injection; foaming, expansion, and viscosity increase take place.
 - 7) Physical properties of the cured foam of approximately: 14 pounds per cubic foot density, 80 to 90 psi tensile strength, and 700% to 800% elongation when a mixture of 50% prepolymer and 50% water undergoes a confined expansion to five times its initial liquid volume.
- f. Urethane base gel chemical sealing material requirements, properties, and characteristics:
- 1) 1 part urethane prepolymer thoroughly mixed with between 5 and 10 parts of water by weight. The recommended mix ratio is 1 part urethane prepolymer to 8 parts of water (11% prepolymer).
 - 2) A liquid prepolymer having a solids content of 77% to 83%, specific gravity of 1.04 (8.65 pounds per gallon), and flash point of 20oF.
 - 3) A liquid prepolymer having a viscosity of 600 to 1200 centipoise at 70oF that can be pumped through 500 feet of 1/2-inch hose with a 1000 psi head at 1 ounce/second flow rate.
 - 4) The water used to react with the prepolymer should be in the pH range of 5 to 9.
 - 5) A cure time of 80 seconds at 40oF, 55 seconds at 60oF, and 3 seconds at 80oF when 1 part prepolymer is reacted with 8 parts of water only. Higher water ratios give longer cure times.
 - 6) A cure time that can be reduced 5 to 10 seconds for water temperatures of 40oF to 80oF when 1 part prepolymer is reacted with 8 parts of water containing gel control agent.

- 7) A relatively rapid viscosity increase of the prepolymer/water mix. Viscosity increases from about 10 to 60 centipoise in the first minute for 1 to 8 prepolymer/water ratio at 50°F.
- 8) A reaction (curing) which produces a chemically stable, nonbiodegradable, tough, flexible gel.
- 9) The ability to increase mix viscosity, density, gel strength, and resistance to shrinkage by the use of additives to the water.

4. Manhole Liners

Manhole liners shall be manufactured of glass fiber reinforced polyester, engineered to support a standard 16,000 pound vertical dynamic wheel load (AASHTO H-20), and meet materials and workmanship requirements of ASTM D 3753. The manhole reducer cone shall have no sidewall joints, seams, or sections.

5. Polyethylene (PE) Pipe

- a. PE sewer liner pipe and fittings shall be manufactured from a polyethylene compound conforming to ASTM D 1248 and meeting the materials requirements for Type III, Class C, Grade Category 5.
 - 1) Pipe made from this compound must have a long-term hydrostatic strength rating of 1600 psi or more, in accordance with ASTM D 2837.
 - 2) When the environmental stress crack resistance (ESCR) of the compound is measured in accordance with ASTM D 1693, Condition C, the compound shall withstand not less than 1,000 hours in 100% solution Igepal CO-630 at 100°F before reaching a 20% failure point (F20).
- b. The liner pipe shall be manufactured in accordance with ASTM D 3035 or ASTM F 714.
- c. Liner Pipe Dimensions: The outside diameter and minimum wall thickness shall conform to dimensions listed in Table I when measured in accordance with ASTM D 2122. Where construction difficulties prevent use of these pipe sizes, other sizes may be specified.

TABLE I
(all dimensions are in inches)

Size of Sewer	OD of Liner	Nominal OD	Minimum Wall Thickness			
			SDR 32.5	SDR 26	SDR 21	SDR 17
4	3.500	3" IPS			.167	—
6	4.500	4" IPS			.214	—
6	5.375	5.375"	.165	.207	.256	.316
8	6.625	6" IPS	.204	.255	.315	.390
8	7.125	7.25"	.219	.274	.339	.419
10	8.625	8" IPS	.265	.332	.411	.507
12	10.75	10" IPS	.331	.413	.512	.632
15	12.75	12" IPS	.392	.490	.607	.750
15	13.38	13.380"	.412	.515	.637	.787
18	16.00	16" IPS	.492	.615	.762	.941
21	18.00	18" IPS	.554	.692	.857	1.059
21	18.70	18.700"	.575	.719	.890	1.100
24	22.00	22" IPS	.677	.846	1.048	1.294
27	24.00	24" IPS	.738	.923	1.143	1.305
30	28.00	28" IPS	.862	1.077	1.333	1.647
36	32.00	32" IPS	.985	1.231	1.524	1.882
42	36.00	36" IPS	1.108	1.385	1.714	—
42	40.00	40" IPS	1.231	1.538		—
48	40.00	40" IPS	1.231	1.538		—
48	42.00	42" IPS	1.292	1.615		—
54	48.00	48" IPS	1.477	1.846		—

NOTE: The wall thickness tolerance shall be within plus 12%. The Standard Dimension Ratio of the pipe to be used shall be as specified in the Special Provisions.

6. Reinforced Plastic Mortar (RPM) Pipe

Reinforced Plastic Mortar (RPM) Pipe for liner in existing sewers shall be manufactured in accordance with ASTM D 3262 or ASTM D 3754 as specified. The pipe shall be manufactured by first applying a liner over a solid surface steel mandrel. The liner shall contain a thermosetting polyester, selected for the intended service, and surfacing veil as reinforcement. No aggregate shall be used in the liner. After the liner is applied, circumferentially oriented continuous glass filaments shall be wound around the liner to provide hoop strength and longitudinally oriented filaments shall be added to provide axial strength. Silica sand-resin mortar shall be added to provide correct ring stiffness. Wall thickness shall remain essentially constant regardless of pressure class. The bell of the pipe shall be manufactured as an integral part of the pipe. The basis of design shall be long-term hydrostatic testing and regression analysis. Long-term hydrostatic testing shall be done in accordance with procedures in ASTM D 2992. Circumferential tensile strengths shall be obtained in accordance with ASTM D 2290.

7. Cured-in-Place Pipe Liner

All materials and procedures used in the inversion process shall be the manufacturer's current standards.

- a. Resin: The thermosetting resin shall be specifically blended for use with the inversion process and be chemically stable and resistant to concentrations of acids, alkalis, and organics found in normal sewage unless indicated otherwise.
- b. The felt tubular material shall be lined on one side with a waterproof coating such as polyurethane or polyvinyl chloride (PVC), and fully impregnated with a liquid thermosetting resin as specified. The tubing shall be properly sized to the diameter and length of the sewer pipeline to be rehabilitated. The material thickness shall generally be a minimum of 0.236 inches with a tolerance of .0625 inch plus or minus. The nominal specified thickness for each pipe section shall be designated on the plans. The cured pipe material shall conform to the following minimum structural standards:

<u>Cured Pipe Material Test</u>	<u>Standard</u>	<u>Results</u>
Tensile Stress	ASTM D 638	3,000 psi
Flexural Stress	ASTM D 780	3,000 psi
Modulus of Elasticity	ASTM D 790	300,000 psi

8. Pipeline Replacement

Pipe shall be as specified in Section 02561.02.

9. Manhole Rehabilitation and Replacement

- a. Flexible plastic gaskets shall be as specified in Section 02562.02.
- b. Cast-in-place concrete shall be as specified in Section 03300, Mix Number as indicated on the Standard Details or the Plans.
- c. Precast concrete sections and grade rings shall be as specified in Section 03400.
- d. Mortar for placing precast concrete grade rings shall be as specified in Section 04100.02.
- e. Brick for manhole inverts shall be sewer brick as specified in Section 04200.02.
- f. Manhole frames, covers, and steps shall be as specified in Section 05500.02. Covers shall be in accordance with the Standard Details.
- g. Waterproofing and bentonite for manhole exterior shall be as specified in Section 07130.02.
- h. Manhole interior wall rehabilitation compounds shall be Drycon as supplied by I.P.A. Systems, Inc., Brush-Bond as supplied by Preco Manufacturing, or County approved equal.

- i. Curing compound shall be as specified in Section 02562.02.

02565.03 EXECUTION

A. Sewer Pipe Cleaning

1. General

The intent of sewer pipe cleaning is to remove foreign materials from the sewer and restore the pipeline to a minimum of 95% of the original pipe diameter or cross-section as required for proper seating of internal pipe joint sealing packers or as required for installation of pipe liners. It is recognized there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. Should such conditions be encountered, the Contractor shall notify the County of the location and nature of obstruction. The County will evaluate the obstruction and will direct the Contractor as to the amount and method to be used to clean those specific pipe sections if cleaning is determined by the County to be feasible. If in the course of normal cleaning operations, damage results from preexisting and/or unforeseen conditions such as broken pipe, the Contractor will notify the County of the location and nature of the damage. The Contractor will be required to make repairs at the Contractor's cost only when the County has determined the contractor was negligent in performance of the Contractor's cleaning operations.

2. Cleaning Equipment

a. Hydraulically Propelled Equipment

- 1) Equipment used for gravity pipelines shall be of a movable dam type and be constructed in a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be County approved equal in diameter to the pipe being cleaned and provide a flexible scraper around the outer periphery to insure removal of grease.
- 2) Pressure pipelines may be cleaned by use of pipe pigs specifically designed for the condition, size, and type of pipe being cleaned.

b. High-Velocity Jet (Hydrocleaning) Equipment: All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees to the axis of the pipe for all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls benches and inverts. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hose reel.

c. Mechanically Powered Equipment

- 1) Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the sewer will not be allowed.
- 2) Power rodding machines shall be either sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be fabricated of heat-treated steel.

3. Sewer Cleaning

The designated sewer manhole sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanically powered equipment. Selection of equipment used shall be based on the method indicated in the "Special Provisions" or at the time work commences where no specific method is indicated in the "Special Provisions." The equipment and methods selected shall be satisfactory to the County. The equipment shall be capable of removing dirt, grease, rocks, sand, other materials and obstructions from the sewer lines and manholes. If cleaning an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning attempted again.

4. Root Removal

- a. Roots shall be removed in sections where root intrusion is a problem. Special attention should be used during the cleaning operation to assure almost complete removal of roots from pipe joints. Any roots which could prevent seating of the packer, the insertion of a pipe liner, or proper application of chemical crack or joint sealants shall be removed. Root removal techniques may include use of mechanical equipment such as rodding machines, bucket machines or winches using root cutters, and porcupines; equipment such as high-velocity jet cleaners; or chemical root treatment at the option of the Contractor.
- b. To aid in removal of roots, manhole sections identified to have root intrusion may be subjected to a chemical root treatment with an approved herbicide. The application of herbicide to the roots shall be done in accordance with the manufacturer's recommendations in a manner as to preclude damage to surrounding vegetation. Any damaged vegetation identified by the County shall be replaced by the Contractor at no additional cost to the County. All safety precautions recommended by the chemical manufacturer shall be observed by the Contractor during handling and application of the herbicide.

5. Material Removal

All sludge, dirt, sand, rocks, grease, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing of material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage to pumping equipment, will not be permitted.

6. Force Main Cleaning

Force mains shall be cleaned using hydraulically propelled or mechanically powered equipment. Hydraulically propelled pigs shall be inserted into the force main at designated locations or at

other approved locations. Mechanically pulled scrapers may be used when conditions warrant. Equipment selected shall be capable of removing dirt, grease, sand, and other materials and obstructions from the lines.

7. Disposal of Materials

All solids or semisolids resulting from the cleaning operations shall be removed from the site transported in watertight vehicles, and disposed of at an approved disposal facility site obtained by the Contractor. All materials shall be removed from the site, transported in watertight vehicles, no less often than at the end of each work day. Under NO circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers approved by the County.

B. Sewer Flow Control

1. Flow Reduction

When sewer line depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for television inspection, joint testing, and/or sealing; the flow shall be reduced to the level indicated below by operation of pumping stations, plugging or blocking of flow, or by pumping and bypassing of flow as required.

2. Depth of Flow

Depth of flow shall not exceed that indicated below for the respective pipe sizes as measured in the manhole when performing television inspection, joint testing, and/or sealing.

a. Maximum depth of flow for television inspection:

6" - 10" Pipe.....	20% of pipe diameter
12" - 24" Pipe.....	25% of pipe diameter
27" & up Pipe.....	30% of pipe diameter

b. Maximum depth of flow for joint testing/sealing:

6" - 12" Pipe.....	25% of pipe diameter
15" - 24" Pipe.....	30% of pipe diameter
27" & up Pipe.....	35% of pipe diameter

3. Plugging or Blocking

A sewer line plug shall be inserted into the line upstream of the manhole section being worked. The plug shall be so designed that all or any portion of the sewage can be released. During TV inspection, testing, and sealing operations, flow shall be reduced to within limits specified above. After the work has been completed, flow shall be restored to normal.

4. Pumping and Bypassing

When pumping and bypassing is required, the Contractor shall furnish temporary pumps, conduits, and other equipment to divert the flow of sewage around the manhole section in which work is to be performed. The bypass system shall be of sufficient capacity to transport existing flow plus additional flow that may occur during a rainstorm. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system and man the bypassing operation on a 24-hour, 7-day per week basis until bypass operations are completed. Pump engines shall be equipped with exhaust silencers to keep noise to a minimum. The system shall be so constructed as to prevent spills from leaving the immediate vicinity of the site. Any spillage that occurs shall be immediately cleaned up and the site returned to a clean sanitary condition. Bypassing plans to be reviewed and approved by County prior to setup. County Utility Operations to be prior notified of extent of bypassing operations.

5. Flow Control Precautions

When flow in a sewer line is plugged, blocked, or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. In addition, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

C. Television Inspection

1. Pipe designated for inspection shall be examined by closed circuit television techniques.
2. Before visual inspection, the pipe shall be cleaned as specified in Section 02565.03, Article A, "Sewer Pipe Cleaning."
3. The inspection will be done one pipeline section (between two manholes) at a time. The flow in the section being inspected will be controlled as specified in Section 02565.03, Article B, "Sewer Flow Control."
4. The television camera used for inspection shall be specifically designed and constructed for such inspection. Lighting for the camera shall be sufficient to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing a picture quality satisfactory to the County. Unsatisfactory equipment shall be removed and no payment will be made for an unsatisfactory inspection.
5. The camera shall be moved through the pipeline in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition and at every house connection from which flow is evident. The camera shall remain at that location until the flow from the connection stops or until the sources of the flow has been determined. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire pipe section, the Contractor shall reset the Contractor's equipment so the inspection can be performed from the opposite manhole. If, again, the

camera fails to traverse the entire pipe section, the County shall determine if the pipe is obstructed and if the County determines the pipe is obstructed, the inspection work shall be considered complete, the pipe designated as obstructed, and no further inspection work will be required in that pipeline section.

6. When manually operated winches are used to pull the television camera through the line, suitable means of communications shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.
7. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be made above ground by a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be permitted. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device before beginning the inspection work.
8. Documentation of the television results shall be as follows:
 - a. Television Inspection Logs: Inspection logs to be provided both as hard copies in a binder, and electronically, in PDF format. One copy of typed location records shall be prepared from field inspection logs maintained by the Contractor which clearly indicate the location, in relation to an adjacent manhole, of each infiltration point and its estimated quantity of leakage observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, obstructions, presence of scale and corrosion, and other discernible features will be recorded.
 - b. Photographs: Digital photos, instant developing, 35 mm, or other standard size photographs of the television picture of problems shall be taken by the Contractor, and furnished the County as a part of the Inspection Logs. Digital images shall be provided as hard copy and on a CD.
 - c. Videotape Recordings:
 - 1) The videotaped recording shall be transferred to DVD format for viewing on either a computer or on a TV. DVDs to be supplied in a hard sleeve; DVD to be labeled with date, time, manhole reach (MH# to MH#). Contractor to use County manhole numbering.
 - 2) The purpose of tape recording is to supply a visual and audio record of the entire length of pipeline inspected. Videotaped recording playback shall be at the same speed as recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. Title to the tape shall remain with the Contractor; however, the County shall be provided a copy of all tapes/DVDs at the completion of the project as part of inspection documentation. The Contractor shall have all videotapes and necessary playback equipment readily accessible for review by the County during the project until a record copy has been made, after which time the tapes may be erased at the Contractor's option.

- 3) Defects shall be documented and quantified verbally by the audio portion of the videotapes by the Contractor as well as in the written inspection logs. Approximate stationing shall be shown on the screen and will be reflected in the inspection log.
- 4) The DVDs will be reviewed by the Engineer for focus, lighting, clarity of view, and technical quality. The Contractor shall maintain sharp focus, proper lightening, and clear, distortion free viewing during the camera operations. Failure to maintain these conditions will result in rejection of the videotape by the Engineer. Any videotape not acceptable to the Engineer will be retelevised at no expense to the County.
- 5) The County has standardized on the NASSCO's PACP program for pipe evaluation. The Contractor must use PACP protocols and standards for the pipe inspection. Contractor to provide proof of NASSCO certification in PACP and at least five (5) years of experience in closed-circuit television sewer and manhole inspection.

D. Sewer Pipe Joint Testing

1. Before pipe joint testing, the pipe section to be tested shall be cleaned as specified in Section 02565.03, Article A, "Sewer Pipe Cleaning."
2. Before starting the pipe joint testing phase of the work, a two-part control test shall be performed as follows:
 - a. To insure accuracy, integrity, and performance capabilities of the testing equipment, a demonstration test shall be performed in a test cylinder constructed in a manner that a minimum of two known leak sizes can be simulated. This technique will establish test equipment performance capability in relationship to the test criteria and insure there is no leakage of the test medium from the system or other equipment defects that could affect the joint testing results. If this test cannot be performed successfully, the Contractor shall repair or otherwise modify the Contractor's equipment and reperform the test until the results are satisfactory to the County. This test may be required at any other time during the joint testing work if the County suspects the testing equipment is not functioning properly.
 - b. After entering each manhole section with the test equipment, but before commencement of joint testing, the test equipment shall be positioned on a section of sound sewer pipe between pipe joints, and a test performed as specified. This procedure will demonstrate reliability of the test requirement, as no joint will test in excess of the pipe capability. Should the barrel of the sewer pipe not meet the joint test requirements, the requirements may be modified as necessary.
3. Pipe joint testing will be performed on a pipe section (between two manholes) basis.
4. The Contractor shall control flow in the pipe section undergoing crack and joint sealing in accordance with Section 02565.03, Article B, "Sewer Flow Control."
5. Sewer pipe joints visibly leaking will not require pressure testing but shall be classified as defective and designated for repair. Each sewer pipe joint not visibly leaking shall be

individually tested at a test pressure equal to 0.5 psi per vertical foot of pipe depth below the ground surface plus 1 to 2 psi (not exceeding a test pressure of 10 psi) in accordance with one of the following procedures:

a. Liquid Test Procedure

- 1) The testing device shall be positioned within the pipeline in a manner to straddle the pipe joint to be tested.
- 2) The testing device ends (end elements, sleeves) shall be expanded to isolate the joint from the remainder of the line and create a void area between the testing device and pipe joint. The ends of the testing device shall be expanded against the pipe with sufficient pressure to contain a minimum of 10 psi within the void without leakage past the expanded ends.
- 3) Water or an equivalent liquid shall then be introduced into the void area until a pressure equal to or greater than the required test pressure is observed by the void pressure monitoring equipment. If the required test pressure cannot be developed (due to joint leakage), the joint will fail the test and will be classified as defective.
- 4) The flow rate of the test liquid shall then be regulated to a rate at which the void area pressure is observed to be the required test pressure. A reading of the test liquid flow meter shall then be taken. If the flow rate exceeds 1/4 gallon per minute (due to joint leakage), the joint will fail the test and will be classified as defective and designated for repair.

b. Air Test Procedure

- 1) The testing device shall be positioned within the line in a manner to straddle the pipe joint to be tested.
- 2) The testing device ends (end elements, sleeves) shall be expanded to isolate the joint from the remainder of the line and create a void area between the testing device and pipe joint. The ends of the testing device shall be expanded against the pipe with sufficient pressure to contain a minimum of 10 psi or the test pressure whichever is greater within the void without leakage past the expanded ends.
- 3) Air shall then be introduced into the void area until a pressure equal to or greater than the required test pressure is observed with the void pressure monitoring equipment. If the required test pressure cannot be developed (due to joint leakage), the joint will fail the test and will be classified as defective and designated for repair.
- 4) After the void area pressure is observed to be equal to or greater than the required test pressure, the air flow shall be stopped and a 5 second stabilization period shall commence. If the void area pressure decays by more than 0.5 psi within 20 seconds (due to joint leakage), the joint will fail the test and will be classified as defective and designated for repair.

6. During the joint testing work, records shall be maintained by the Contractor which indicate:

Identification of the pipe section tested;

Test method used;

Test pressure used;

Location (footage) of each joint tested;

A statement indicating the test results (passed or failed) for each joint tested.

E. Sewer Pipe Joint Sealing

1. General

The intent of sewer pipe joint sealing work is to seal sewer pipe joints which have been designated as defective using the internal joint sealing method. It is recognized this method may only be used on sewer pipe sections in sound physical condition. Longitudinally cracked or broken pipe will not be sealed. When bell cracks or chips are evident from pipe section offset, sealing may be undertaken where the offset is small enough to allow proper seating of the sealing packer on both sides of the joint to be sealed.

02566.04 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

02566.05 BASIS OF PAYMENT

RESERVED FOR FUTURE USE

SECTION 02566

LOW-PRESSURE SEWER SYSTEMS

02566.01 GENERAL

A. Description

Low-pressure sewer system installation shall include, but not necessarily be limited to, furnishing and installing sewage grinder pumps and chambers; gravity and pressure pipes, valves, fittings, and appurtenances; and pump control and high water alarm panels at the locations shown on the Plans and in accordance with the Contract Documents and approved installation details.

Unless otherwise noted in the Contract Documents all grinder pumps shall be privately owned, operated, and maintained.

B. Related Work Included Elsewhere

1. Trench excavation, backfill, and compaction; Section 02250.
2. Sanitary sewer and sanitary house connection installation; Section 02561.
3. Cast-in-place concrete; Section 03310.
4. Precast concrete utility structure installation; Section 03400.

C. Quality Assurance

1. Materials
 - a. The County will inspect all materials before and after installation to ensure compliance with these Contract Documents. When specific materials tests are called for in the referenced standards and specifications the County shall have the option of requiring that any or all of these tests be performed for materials furnished for a specific project. When testing is required, it shall be so specified in the "Special Provisions."
 - b. Polyvinyl chloride (PVC) pipe and fittings shall be homogeneous throughout and free from visible cracks, bubbles, blisters, holes, foreign inclusions, cuts, or scrapes on inside or outside surfaces, or imperfections which may impair the performance or life of the pipe. If ductile iron fittings are used with PVC pipe, then the fittings shall be coated with a hydrogen sulfide resistant coating such as Protecto 401.
 - c. Cast iron soil pipe and ductile iron pipe (DIP) and fittings shall be sound and without defects that will impair its service. Repairing defects by welding or other method will not be allowed if such repairs will adversely affect the serviceability of the piece.

- d. Electrical equipment and materials shall be new, listed by UL, and bear the UL label where UL requirements apply. Similar items in the project shall be the products of the same manufacturer. Equipment and materials shall be of industrial grade and of standard construction.

2. Field Tests

a. General

- 1) After installation, grinder pumps and chambers, gravity and pressure piping and appurtenances, and connections will be inspected by the County and shall be Contractor tested for compliance with the Contract Documents. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the specified tests.
- 2) The Contractor shall schedule all tests with the County at least 48 hours in advance, and shall conduct all acceptance testing in the presence of the County.
- 3) If the gravity pipe, pump chambers, PVC pressure pipe, pressure sewer main connections, sewage grinder pumps, or electrical control and alarm systems fail the inspections and/or tests, the Contractor shall, at the Contractor's own expense, replace, repair, adjust, seal, or reseal the failed component until all requirements are met. The County will furnish personnel to witness one test only. If additional tests are required, all costs of County personnel will be paid by the Contractor.
- 4) All PVC pipe installation shall include a tracer wire and marker tape in accordance with Section 02551 with the exception that the marker tape shall be stenciled with the word "SEWER".

b. Gravity Pipe

- 1) Gravity pipe will be inspected for proper pitch prior to backfill. Minimum pitch for 4-inch diameter drain pipe is 1/4 inch per foot.
- 2) Gravity pipe shall be visually inspected for evidence of leakage and material damage.

- c. Pump chambers and other structures will be visually inspected by the County for leakage. No visible leakage shall be allowed.

- d. Polyvinyl chloride pressure pipe, valves, and fittings shall be hydrostatically pressure tested by the Contractor in accordance with the following:

The pipeline under test shall be filled with water, all air eliminated from the system, and the system pressurized to 100 psi at the highest point under test. Valves in the line shall be opened full and closed while the line is under test pressure. The pipeline will be accepted if it can hold 100 psi for 1 hour without any evidence of leaking.

e. Pressure Sewer Main Connections

No testing will be conducted on grinder pump connections to existing pressure sewer mains, however, the work will be visually inspected for leakage during the pump testing specified in the following paragraph. No visible leakage will be permitted at the connection.

f. Sewage Grinder Pumps

The Contractor shall conduct a field test of each installed sewage grinder pump unit to demonstrate that the pumping units are operating in a satisfactory manner and in accordance with the requirements of this Section. Each pump shall be operated through at least two normal and two alarm cycles.

g. Electrical control and alarm systems shall be tested to demonstrate that they operate in the manner intended. Pump start and stop and high water alarm shall be demonstrated.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for the following materials, and include the following information:

- a. Polyvinyl chloride (PVC) pipe and fittings: product information and dimensions; Schedule or SDR number; storage, handling, and installation recommendations.
- b. Shut-off, check, anti-siphon, air release valves, combination air/vacuum valves, corporation valves, valve boxes, and miscellaneous appurtenances: product description, parts list, detailed assembly drawings, and maintenance requirements and procedures.
- c. Sewage grinder pumps: product description; parts and materials list; certified performance curves showing head versus capacity and power input versus capacity at normal operating speed over a capacity range of 0 to 20 gallons per minute; dimensioned outline drawings; wiring diagrams and schematics; detailed installation and user instructions including operation and maintenance manuals and weight of concrete anchor to prevent flotation for each unit furnished; evidence of an established service support program, and evidence of experience in design and manufacture of grinder pumps for low-pressure sewage systems.
- d. Electrical equipment: product description, catalog data, parts and materials list, connection diagrams, terminal diagrams, internal wiring diagrams, conductor sizes, finish, nameplates, and location of conduit entrances and access plates.

2. Certificates of Compliance

- a. Certificates of compliance shall be submitted as specified in the "General Provisions" for all pipe and fittings stating the item supplied is in accordance with the requirements specified herein.
- b. Electrical work shall conform to the rules and regulations of the National Electrical Code (NEC). The Contractor shall obtain all necessary permits and certificates, including the

certificates of final inspection and approval, as required by the Charles County Department of Planning and Growth Management. All costs associated with obtaining such permits and inspections shall be the sole responsibility of the Contractor. Upon completion of the entire electrical work, the Contractor shall present to the County all certificates of inspection and approval.

3. Certified Test Results

Certified test results shall be submitted as specified in the "General Provisions" for the following:

- a. Cast iron soil pipe and fittings;
- b. Ductile iron pipe and fittings;
- c. Polyvinyl chloride (PVC) gravity sewer pipe and fittings;
- d. Polyvinyl chloride (PVC) pressure sewer pipe and fittings.

4. Sewage Grinder Pump Manufacturer's Certificate and Warranty

- a. Manufacturer's Certificate for the sewage grinder pump shall state that the equipment has been installed under either continuous or periodic supervision of the manufacturer's authorized representative, it has been adjusted and initially operated in the presence of the manufacturer's authorized representative, it is operating in accordance with the specified requirements, and to the manufacturer's satisfaction.
- b. In addition to the Contractor's guarantee as outlined in the "General Provisions", the manufacturer shall warrant its product to be free from defects in material and factory workmanship for a period of one year from date of Substantial Completion Acceptance, provided the product is properly serviced and operated under normal conditions and according to the manufacturer's instructions. Repair or parts replacement required as a result of any defect will be made without charge during this period.
- c. The grinder pump shall be free from electrical and fire hazards and suitable for residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump in its tank shall be listed by Underwriters' Laboratories, Inc.
- d. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, be free from noise, odor or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in low-pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the National Sanitation Foundation, or other similarly accredited testing organizations', seal of approval.

02566.02 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for low-pressure sewer systems.
2. The Contractor may obtain potable water from the County's potable water system for testing the low pressure sewer system. The Contractor shall contact the Department of Public Works, Utilities Division, for requirements. A backflow prevention device must be placed in accordance with the Standard Details prior to drawing County water.

B. Contractor's Options

1. The Contractor may furnish Schedule 80 or SDR 21 pipe polyvinyl chloride (PVC) for pressure lines, unless otherwise indicated in the Contract Documents.
2. The Contractor may furnish precast or cast-in-place construction for terminal flushing connection vaults unless otherwise noted.

C. Detailed Material Requirements

1. Portland cement concrete for pipe anchorages and buttresses sewage grinder pump anchors, and valve box supports shall be Mix No. 1 as specified in Section 03310.
2. Cast iron soil pipe and fittings shall be as specified in Section 02561.02.
3. Ductile iron pipe and fittings shall be as specified in Section 02551.02 except that the minimum working pressure specified therein will not apply. Pipe Class shall be as shown on the Plans.
4. Pipeline coupling type adapters for connecting different pipe materials and sizes in gravity lines shall be as specified in Section 02561.02.
5. Pressure Pipe
 - a. General
 - 1) Polyvinyl chloride (PVC) pressure pipe for low-pressure sewer systems shall be manufactured from PVC compounds meeting the requirements of ASTM D 1784, Class 12454B. Pipe joints shall be as specified herein and elsewhere in the Contract Documents for various locations within piping systems.
 - 2) Solvent-cemented pipe joints at gravity grinder pumps stubs, and where shown on the Plans shall meet the materials and workmanship requirements of ASTM D 2672. Schedule 80 pipe fittings shall have solvent-cemented joints meeting the materials, workmanship and dimensional requirements of ASTM D 2466. Primer shall meet the materials requirements of ASTM F 656. Solvent cement shall meet the materials requirements of ASTM D 2564.
 - 3) Rubber gaskets for gasketed joints shall meet the materials requirements of ASTM D 477. Gaskets and lubricants shall be made from materials that are compatible with the pipe material and will not support bacterial growth.

- b. Pressure sewer pipe shall be pressure rated SDR 21 pipe meeting materials, design, test, certification, and marking requirements of ASTM D 1785 or Schedule 80 pipe meeting the materials, design, test, certification, and marking requirements of ASTM D 1785. Pressure sewer mains 1 ½-inch diameter and larger, unless otherwise shown in the Contract Documents shall have gasketed joints in accordance with ASTM D 3139. Sewage grinder pump discharge pipe smaller than 1 ½-inch diameter shall have solvent-cemented joints. Threaded connections to schedule 80 pipe shall only be made using solvent-by-threaded adapters.
 - c. Pressure sewer fittings shall be Schedule 80 IPS fittings conforming to the materials, design, test, certification and marking requirements of ASTM D 1785.
 - d. Threaded pipe and fittings shall be Schedule 80 Physical dimensions and tolerances of PVC Schedule 80 pipe shall conform to ASTM D 1785. Threaded Schedule 80 fittings shall conform to ASTM D 2464.
6. Gravity sewer pipe and fittings shall be as specified in Section 02561.02.
 7. Service tees for sewage grinder pump to pressure sewer main connections shall be in accordance with Paragraphs 5.a and 5.b above and shall have gasketed mainline joints and female socketed outlets. Mainline and outlet sizes shall be as shown on the plans.
 8. Couplings for connecting plain-end pieces of PVC pressure sewer pipe shall be furnished with end rings and gaskets specifically sized for polyvinyl chloride (PVC) pipe. The couplings shall have ductile iron center and end rings meeting ASTM D 536, gaskets made from virgin SBR suitable for use with sewage and meeting ASTM D 200, and galvanized steel bolts and nuts.
 9. Tapping saddles for connections to existing polyvinyl chloride (PVC) mains 4-inch diameter and larger shall be manufactured of high tensile ductile iron, ASTM A 536, protected with corrosion resistant paint. Saddles shall be furnished with two stainless steel straps and a rubber gasket suitable for use with sewage.
10. Valves
 - a. Check valves shall be gravity-operated flapper-type with injection molded polyvinyl chloride (PVC) bodies. Valves shall have a full parted passageway and solvent-cemented joint ends. Working parts shall be made of a 300 series stainless steel and/or non-metallic synthetic resins.
 - b. Ball Valves
 - 1) Provide bronze body ball valves at service valve assemblies. Valves shall be supplied by the same manufacturer and suitable for the conveyance of raw sewage. All ball valves shall be full circle/opening valves.
 - 2) For pipe diameters less than 3-inches, use ball valves. For pipe diameters greater than or equal to three inches in diameter, use plug valves. The ball valve shall be suitable for use with sewage.

- 3) Plug valves shall be furnished in accordance with the requirements of Section 02563 and be suitable for use with sewage.
- c. Gate Valves
- 1) Provide bronze body gate valves at service valve assemblies. Provide iron body gate valves on the gravity connections and other valve locations designated on the Plans and in the Standard Details. Valves shall be supplied by the same manufacturer and suitable for the conveyance of raw sewage.
 - 2) The bronze body gate valves shall be non-rising stem, double wedge design, fitted with an extension stem and 2-inch square operating nut extending to within four (4) foot of finished grade. The valve shall turn left (counterclockwise) to open and the valve component shall be of ample strength to withstand and operate under a working pressure of 150 psi, unless otherwise noted and shall be otherwise suitable for use with sewage.
 - 3) The iron body gate valves shall be furnished in accordance with the requirements of Section 02552 and be suitable for use with sewage.
- d. Corporation stops at the pressure sewer main shall have iron pipe threaded inlets and outlets and shall be Mueller H-10045, Mueller H-10012, or County approved equal. The corporation stop shall be connected to the sewer main through the use of a County approved saddle.
- e. Curb stops in the sewage grinder pump discharge lines shall have iron pipe threaded inlets and outlets and shall be Mueller Mark II Oriseal, No. H-10283, or County approved equal. A curb box marked "SEWER" shall also be installed in accordance with the Standard Details.
- f. Plug valves, sewage air release valves and combination air/vacuum valves shall be the size and type indicated on the Plans and as specified in Section 02563.
11. Valve boxes shall be as specified in Section 02552.02, except the covers shall be labeled "SEWER".
12. Grinder pump systems shall be Model DH071 (simplex) and/or Model DH152 (duplex), with accessways, as manufactured by Environment/One Corporation as indicated on the Plans.
- a. The units shall be factory preassembled complete with one or two grinder pumps (depending on model) with check valves, high density polyethylene (HDPE) tank, controls, integral accessway and bolt-down lid. Accessway height shall be as indicated on the Plans and extend at least 6 inches above the finished grade. The pump enclosure shall come with 4-inch socket type inlets, sized for PVC DWV pipe and a 1-1/4 inch NPT outlet. All seals shall be factory tested for watertightness.
 - b. The pumping units shall be integral, vertical rotor, motor driven progressing cavity type with a single mechanical seal; The pumps shall be capable of delivering 15 GPM against a rated

- total dynamic head of 0 feet (0 PSIG), 11 GPM against a rated total dynamic head of 92 feet (40 PSIG), and 7.8 GPM against a rated total dynamic head of 185 feet (80 PSIG). The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.
- c. The capacitor start, induction motor shall be 1 horsepower, 1725 RPM, rated at 240 volts, single phase, 60 hertz, and shall come with an automatic-reset, integral thermal overload protector. The pump rotor shall be throughhardened, highly polished precipitation hardened stainless steel and directly connected to the grinder mechanism.
 - d. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance.
 - e. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.
 - f. Pumps shall be capable of intermittent operation (3 minutes minimum) at any head up to 125% of normal rated dynamic head with a minimum flow of 8 gallons per minute.
 - g. The grinder pump station shall have a cartridge type, easily removable core assembly with lifting eyes, consisting of pump, motor, grinder, all motor controls, check valve, anti-siphon valve, level controls, electrical quick disconnect and wiring. The core unit shall be installed in the basin by the manufacturer. Field assembly of the pump and controls into the basin is not acceptable because of potential workmanship issues and increased installation time. The core unit shall be removable and provided with shut-off valve and quick disconnect piping and electrical connections containing a quick disconnect coupling in the accessway and ten (10) feet of control and power cable to allow rapid exchange of the entire core unit from the accessway and so the core units may be exchanged with other units in the County. Special wrenches and/or other special tools for core unit exchange shall be furnished with each unit and shall be securely stored inside the accessway and be of sufficient length to permit core removal from ground level. A rope or cable for extracting the core unit shall be fastened to lifting hooks on the core unit and secured to the top of the accessway.
 - h. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit.

- i. The accessway and the panel shall be furnished with an approved locking device and lock. Two sets of keys, tagged for the specific location, shall be provided to the County by the contractor.
- j. Spare replacement core units shall be provided for the number indicated in the Special Provisions.

13. Electrical Equipment

- a. Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.
 - 1) The alarm panel shall be the Extreme Option Package which includes all the following features:
 - a. Basic Package: circuit breakers, 120/240 V service, terminal blocks and ground lugs, audible alarm with manual silence, manual run feature and run indicator, redundant "start" function with high level alarm, safety front, conformal-coated board, overload protection.
 - b. Protect Package: trouble indication that shuts down the pump temporarily in the event of an unacceptable operating condition (brownout, system over-pressure, run-dry).
 - c. All features of the PreSTAT Package: predictive status display module, pre-alarm and alarm indication for major operating parameters, programmable auto-dialer, hour meter, cycle counter and alarm delay, LCD display and user-friendly interface, inner cover (dead front), contact group (dry, powdered and Remote Sentry).
 - d. The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability.
- b. Single conductors shall be stranded copper with type THWN insulation. Cables installed underground shall be type UF. Conductor size shall be as noted on the Approved Installation Details or Plans. Grounding electrode conductors shall be insulated. Equipment grounding conductors shall be insulated. Insulated equipment grounding conductors shall have greencolored insulation.
- c. Conduit

Except as otherwise noted, conduit and fittings shall be Schedule 40 polyvinyl chloride, conforming to UL Standard 651 and manufactured by Carlon, Hatfield Wire and Cable, or County approved equal. Buried conduit shall be at least 18-inches below grade and will terminate within one foot of grinder can or pedestal.

Rigid galvanized electrical metallic tubing shall conform to ANSI Standard C80.3 and shall be manufactured by Republic Steel Corporation, Triangle PWC Incorporated, or equal. Fittings shall be watertight, compression type, manufactured by Thomas and Betts, OZ/Gedney Company, or equal.

d. Nuts, bolts, screws, etc. shall be Type 304 stainless steel.

14. Tracer wire shall be installed with non-metallic pipelines. Marker tape shall be installed with the buried sewer and electric lines. The tape shall be furnished with an appropriate message imprinted on a colored background warning of buried sewer or electric line.

02566.03 EXECUTION

A. Sewage Grinder Pumps

1. The sewage grinder pump units shall be installed and wired in accordance with the "Standard Drawings" for sewage grinder pumps, as specified herein, and as directed by the County.
2. The unit shall be handled by the lifting eyes furnished with the unit and in accordance with the manufacturer's recommendations. Units shall be set plumb on a firm foundation of granular material as shown, and a concrete anchor poured around the tank section. The concrete shall extend at least 6 inches above the lip around the center of the tank plus such additional concrete as required to prevent flotation of the unit in accordance with the approved Shop Drawings. Furnish sleeves if the concrete extends above the inlet and outlet piping.
3. Electrical
 - a. The Contract Documents indicate general arrangements and locations for equipment, conduit, and other work. Installed locations shall be determined in the field after a careful review of site conditions, approved Shop Drawings, and the Contract Documents to assure a workable installation. Independent power sources for each pumping unit shall originate at the serviced structure.
 - b. Grounding of all electrical installations shall be in accordance with the National Electrical Code and the requirements of the Southern Maryland Electric Cooperative. Maintain ground continuity throughout the system by installing a separate stranded copper green-insulated conductor with all branch circuit and feeder wiring installed in conduit. Connect the grounding conductor to the supplemental grounding system as well as the existing ground system. Size the grounding conductors as indicated and specified and install grounds in accordance with National Electrical Code.
 - c. Connections to equipment shall be in accordance with the manufacturer's recommendations with regard to size and arrangement.
 - d. Wall-hung equipment shall be anchored in place in a rigid and secure manner, utilizing fastenings that are appropriate for the load and the mounting surface. All cabinets shall be spaced minimum 1/4 inch away from walls by means of metal spacers or performed

projections on the cabinet to automatically provide the required space between the cabinet and the mounting surface.

e. Conductor and Equipment Identification

- 1) Provide identification to facilitate the control of circuits and equipment. Provide identification labels on all wires in every cabinet and outlet box.
- 2) Color code 120/420 volt system conductors as follows: black, Phase A; red, Phase B; and white, neutral. Utilize color coding tape where colored insulation is not available.

B. Solvent-Cemented Polyvinyl Chloride (PVC) Pipe Joints

Solvent-cemented polyvinyl chloride (PVC) pipe joints shall be assembled only by personnel knowledgeable and experienced in properly making solvent type joints in accordance with the solvent cement manufacturer's recommendations, as specified in ASTM D 2855, and as detailed herein.

1. Ends shall be cut square with the pipe axis using a fine-tooth hand or power saw. Pipe cutters not specifically designed for cutting plastic pipe or that raise a burr or ridge at the cut end of the pipe shall not be used. Cut ends shall be chamfered and deburred prior to joint assembly.
2. Surfaces to be joined shall be cleaned and free of dirt, moisture, oil and other foreign material. Cleaning shall be accomplished by wiping with a clean dry cloth, a chemical cleaner, or mechanical means. The surface temperature of the mating surfaces shall not exceed 110oF at the time of assembly. Pipe and fittings shall be shaded from direct exposure to the sun prior to assembling the joints if required.
3. The inside socket surfaces and the male end of the pipe shall be softened by application of one or more coats of primer. After the surfaces have been softened, and while still wet with primer, cement shall be applied to both surfaces in a uniform and even manner, taking care to keep excess cement out of the socket. Immediately after applying the last coat of cement to the pipe, and while both the inside socket surface and the outside surface of the male end of the pipe are soft and wet with solvent cement, forcefully bottom the male end of the pipe in the socket. Turn the pipe or fitting one-quarter turn during assembly to distribute the cement evenly. Hold the joints firmly together until the cement has received its initial set.
4. Handle newly assembled joints carefully until the cement has gone through the set period. Set time shall be in accordance with the manufacturer's recommendations or the following, whichever is longer:

<u>Minimum Time</u>	<u>Ambient Temperature</u>
30 minutes	60 to 100°F
1 hour	40 to 60°F
2 hours	20 to 40°F
4 hours	0 to 20°F

Pressure testing shall not be conducted until at least 24 hours after solvent cement joints have been assembled.

5. After the set period, the pipe shall be carefully placed in the trench and snaked from side to side. Minimum loop length and offset shall be 20 feet and 7 inches respectively.

C. Threaded Polyvinyl Chloride (PVC) Joints

When threaded polyvinyl chloride (PVC) joints are called for in the Contract Documents, the following procedures shall be followed:

1. Male and female threaded areas shall be clean and free of sand and dirt.
2. Joints shall be lubricated and sealed with non-hardening pipe dope or Teflon (R) tape.
3. Special care shall be taken when starting threads to prevent cross threading.
4. Hand tighten joint first, then wrench tighten only enough to produce a leak-free joint.

D. Pressure Sewer Connections and Appurtenances

1. Service tees for sewage grinder pump connections to pressure sewer mains shall be installed as the pressure sewer main is being installed. If it should become necessary to install a grinder pump connection where no mainline fitting has been provided, and the mainline size is 3-inch diameter or less, the mainline shall be shut-down, drained, cut, and a new service tee and coupling installed. When called for in the Contract Documents, the outlet side of the service tee shall be fitted with a corporation stop, otherwise a male pipe thread by socket adapter shall be furnished and installed.
 2. Connections to pressure sewer mains 4-inch diameter and larger, when no service tee has been provided and the main is in service, shall be made by using tapping saddles with the "coupon" removed. Saddles and corporation stops of the sizes indicated shall be attached to the main, and the main drilled in accordance with the saddle, pipe, and drill manufacturer's recommendations.
 3. Sewage grinder pump discharge lines shall be valved at the property line or where indicated on the Plans. The Contractor shall furnish and install corporation stops, PVC socket to threaded adapters, valve boxes and covers, and concrete valve box supports in accordance with the Standard Details.
- E. Gasketed polyvinyl chloride (PVC) pressure sewer pipe and fitting shall be installed in accordance with Section 02551.03, except that chlorination is not required.
- F. Polyvinyl chloride (PVC) gravity sewer pipe and fittings shall be installed in accordance with Section 02561.03.

- G. Plug and gate valve installation shall be installed in accordance with Section 02552.03, except that gate valve jointing shall be push-on as specified in Section 02551.
- H. Air release and combination air/vacuum valves shall be installed in accordance with the Standard Details where shown on the Plans.

02566.04 METHOD OF MEASUREMENT

A. Sewage Grinder Pump Units

RESERVED FOR FUTURE USE

B. Polyvinyl Chloride (PVC) Pressure Pipe and Fittings

RESERVED FOR FUTURE USE

C. Sewage Air Release and Combination Air/Vacuum Valves

RESERVED FOR FUTURE USE

D. Flushing Valves and Vaults

RESERVED FOR FUTURE USE

02566.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Sewage Grinder Pump Units

RESERVED FOR FUTURE USE

C. PVC Pressure Sewers

RESERVED FOR FUTURE USE

D. Sewage Air Release and Combination Air/Vacuum Valves

RESERVED FOR FUTURE USE

E. Flushing Valves and Vaults

RESERVED FOR FUTURE USE