

Section 2504. Sanitary Sewers

2504.01 DESCRIPTION.

This section was developed in conjunction with [Sections 4010](#) and [4060](#) of the SUDAS Standard Specifications, with modifications to suit the needs of the Department.

- A.** Construct sanitary sewer gravity and force mains.
- B.** Construct or relocate building sanitary sewer services, stubs, and connections.
- C.** Clean, inspect, and test sanitary sewer gravity mains, sanitary sewer force mains, and sanitary sewer service stubs.
- D.** Clean, inspect, and test rehabilitated pipe.

2504.02 MATERIALS.

A. Sanitary Sewer.

Apply [Article 4149.02](#).

B. Testing Equipment for Cleaning, Inspection, and Testing Sewers and Drains.

1. General.

Comply with applicable sections of ASTM and other applicable industry standards and codes.

2. Video Inspection.

a. Video Camera:

- 1)** High-resolution color with adjustable iris focus.
- 2)** Pan and tilt capabilities.
- 3)** Integral lighting suitable to provide proper illumination and a clear video image of the entire periphery of the pipe.
- 4)** Capable of operating in 100% humidity conditions.
- 5)** Produce a high quality video image.

b. Provide closed circuit video inspection equipment capable of displaying on-screen footage of distance measured to within 1% of actual distance.

C. Inspection Reporting.

Record the inspection in color in the recording media specified by the Engineer. Forward the recording to the Engineer.

2504.03 CONSTRUCTION.

A. Examination.

- 1.** Verify measurements at site. Make necessary field measurements to accurately determine pipe makeup lengths or closures.
- 2.** Examine site conditions to ensure construction operations do not pose hazards to adjacent structures or facilities.

B. Gravity Sewer Installation.

1. General.

- a.** Install watertight plug to prevent water from entering the existing sewer system.
- b.** Inspect pipe for defects before installation. Do not install damaged or defective pipe.
- c.** Clean pipe interior and joints prior to installation. Keep pipe clean during construction.
- d.** Begin at the lowest point in the line. Lay groove or bell end pointing upstream unless specifically noted otherwise.
- e.** Assemble joints according to [Article 2504.03, D](#).
- f.** Cut ends of pipe at manholes and structures with a saw. Do not hammer cut or break pipe.
- g.** Provide manholes as specified in the contract documents.

- h. Install cap, plug, or bulkhead at exposed ends of pipe upon completion of construction or whenever pipe installation is not in progress.

2. Trenched.

- a. Excavate trench and provide pipe bedding and backfill material as specified in [Section 2552](#).
- b. Prepare trench bottom to design line and grade so that only minor movement of the pipe is necessary after installation.
- c. Lay pipe to design line and grade:
 - 1) Install pipe to line and grade specified in the contract documents. Set field grades to invert of pipes.
 - 2) At no additional cost to the Contracting Authority, correct misalignment, displacement, or otherwise defective pipe by removing, relaying, or replacing pipe.
- d. Provide uniform bearing for full pipe barrel length. Excavate bell holes as necessary for uniform support of pipe barrel on bedding material.
- e. Do not lay pipe in water or on saturated soil or bedding, or allow water to rise in trench around pipe prior to placing backfill material.
- f. Do not disturb installed pipe and bedding when using movable trench boxes and shields. Block or anchor pipe as necessary to prevent joint displacement.
- g. Install preformed wye or tee service fitting at each location as specified in the contract documents.

3. Trenchless.

Apply [Section 2553](#).

C. Carrier Pipe Installed within a Casing Pipe.

Apply [Article 2553.03, D](#), for installation of carrier pipe within casing pipe.

D. Gravity Main Pipe Jointing.

1. General.

- a. Clean joint surfaces to remove soil or foreign material prior to jointing pipe.
- b. Assemble joints according to the pipe manufacturer's recommendations. Use equipment that does not apply damaging forces to pipe joints.

2. Polyvinyl Chloride Pipe and Polyvinyl Chloride Composite Pipe (truss-type).

- a. Coat rubber gasket and joint with soap-based lubricant immediately prior to closing joint.
- b. Seal ends of PVC composite and closed profile pipe at manholes with the coating recommended by the manufacturer.

3. Reinforced Concrete Pipe.

Coat rubber gasket and joint with soap-based lubricant immediately prior to closing joint.

4. Ductile Iron Pipe.

- a. Push-on Joint: Coat gasket and joint with soap-based lubricant immediately prior to closing joint.
- b. Mechanical Joint: Wash plain end, bell socket, and gasket with soap solution. Press gasket into socket, set gland, and tighten bolts uniformly.

5. Connections between Dissimilar Pipes.

- a. Use manufactured adapters or couplings approved by the Engineer.
- b. Where adapters or couplings are not available, the Engineer may authorize use of a Type PC-2 concrete collar as shown in the contract documents.

E. Force Main Installation.

1. General.

Install according to [Section 2554](#).

2. Tracer Wire.

- a. Required for all force main installations. Apply [Section 2554](#).

- b. Install tracer wire station at each end of the force main and at additional locations specified in the contract documents.
- c. Bury end of tracer wire station 2 feet (0.6 m) and compact.

F. Sanitary Sewer Service Stubs.

1. Provide sanitary sewer service stubs at locations specified in the contract documents.
2. Install wye or tee for each service connection.
 - a. Connection of sanitary service to new sewer main, except RCP:
 - 1) Use only factory wye or tees.
 - 2) Install according to the manufacturer's requirements and [Articles 4149.02, D](#), and [2504.03, D](#), for joints.
 - b. Connection to existing sewer main and new RCP:
 - 1) Cut sewer main for service tap with hole saw or sewer tap drill.
 - 2) Use preformed saddle wye or saddle tee for service tap. Use a gasketed saddle with rigid pipe mains, and a solvent-cemented saddle with PVC mains.
 - 3) Install according to the manufacturer's requirements, but always with at least two stainless steel band clamps.
3. Install service stub from sewer main to a location 10 feet (3 m) beyond the right of way line or as specified in the contract documents.
 - a. Install according to [Article 2504.03, B](#).
 - b. Install service stub with a slope between 2% and 5% for 4 inch (100 mm) pipes, and between 1% and 5% for 6 inch (150 mm) pipes and greater.
 - c. Terminate end of service stub 10 to 12 feet (3.0 to 3.6 m) below finished ground elevation or as specified in the contract documents.
 - d. If the depth of the sewer main causes the service to exceed a depth of 12 feet (3.6 m) or a slope of 5%, install a service riser.
 - e. For undeveloped properties, place watertight stopper, cap, or plug in end of sanitary sewer service. Mark the end of the service line as required by the Engineer or as specified in the contract documents.
 - f. For reconnection of new service pipe with existing service pipe and new service pipe, comply with the Engineer's plumbing code.

G. Sanitary Sewer Service Relocation.

1. Relocate existing sanitary sewer services that conflict with new storm or sanitary sewer installations. Existing services located within a conflict zone from 6 inches (150 mm) below the bottom of the proposed sewer pipe to 2 inches (50 mm) above the top of the proposed sewer pipe require relocation.
2. When a conflicting service is encountered:
 - a. Determine grades and elevations of the existing service and proposed main.
 - b. Determine the extent of service replacement necessary to relocate the service outside of the conflict zone while maintaining a minimum 1% slope on the sewer service.
 - c. If it is not feasible to maintain a minimum slope of 1% on the relocated service, a special design and additional work may be required. Stop work and contact the Engineer. Do not remove sewer service unless directed by the Engineer.
 - d. If service relocation with a minimum slope of 1% is feasible, proceed with removal and replacement of the existing sanitary sewer service.
 - 1) Length of replacement varies. Remove the existing service to the extent necessary to move the service out of the conflict zone.
 - 2) Use new materials complying with [Article 4149.02, D](#).
 - 3) Re-install the service according to [Article 2504.03, B](#).
 - 4) Maintain a minimum 1% grade on relocated service.

H. Sanitary Sewer Abandonment.

1. Prior to placing the sewer plug, the Engineer will verify the sewer line is not in use.

2. Construct sewer plug by completely filling the end of the pipe with concrete. Force concrete into the end of the pipe for a distance of 16 inches (400 mm), or one half the pipe diameter, whichever is greater.
3. If specified in the contract documents, fill the line to be abandoned with flowable mortar or CLSM, according to [Article 2552.02, E](#), by gravity flow or pumping.

I. Connection to Existing Manhole.

Apply [Article 2435.03, E](#).

J. Tolerances.

Apply the following tolerances to utilities installed by open trench construction. For trenchless construction, comply with [Section 2553](#).

1. Gravity Main.

- a. Do not allow horizontal and vertical alignment of trenched gravity sewer lines to vary from design line and grade at any point along the pipe by more than 1% of the inside diameter of the pipe or 1/4 inch (6 mm), whichever is larger.
- b. This tolerance is allowed for trenched gravity sewer lines only if design line and grade is sufficient to prevent backslope when tolerance limits are reached.
- c. Reverse slope on gravity pipe is prohibited. Remove and reinstall pipe to proper grade.

2. Force Main.

Do not allow horizontal and vertical alignment of trenched force mains to vary from design line and grade by more than 3 inches (75 mm).

K. Conflicts.

1. General.

- a. Provide temporary support for existing water, sewer, gas, telephone, power, and other utilities or services that cross the trench.
- b. Compact backfill material under existing utility crossing as specified in [Section 2552](#), or construct utility line supports where indicated specified in the contract documents or as directed by the Engineer.

2. Horizontal Separation of Gravity Sewers from Water Mains.

- a. Separate gravity sewer mains from water mains by a horizontal distance of at least 10 feet (3 m) unless:
 - The top of a sewer main is at least 18 inches (450 mm) below the bottom of the water main, and
 - The sewer is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet (1 m) from the water main.
- b. When it is impossible to obtain horizontal clearance of 3 feet (1 m) and vertical clearance of 18 inches (450 mm) between sewers and water mains, the sewers shall be constructed of water main materials meeting the requirements of [Article 4149.02, B](#); however, provide a linear separation of at least 2 feet (600 mm).

3. Separation of Sewer Force Mains from Water Mains.

Separate sewer force mains and water mains by a horizontal distance of at least 4 linear feet (1.2 m).

4. Separation of Sewer and Water Main Crossovers.

- a. Vertical separation of sanitary sewers crossing under any water main should be at least 18 inches (450 mm) when measured from the top of the sewer to the bottom of the water main. If physical conditions prohibit the separation, the sewer may be placed not closer than 6 inches (150 mm) below a water main or 18 inches (450 mm) above a water main. Maintain the maximum feasible separation distance in all cases.
- b. Where the sewer crosses over or less than 18 inches (450 mm) below a water main, locate one full length of sewer pipe of water main material so both joints are as far as possible from the water main. The sewer and water pipes shall be adequately supported

and have watertight joints. Use a low permeability soil for backfill material within 10 feet (3 m) of the point of crossing.

L. Cleaning, Inspection, and Testing.

Notify the Engineer at least 24 hours prior to performing testing. The Engineer shall be present to review testing procedures and record results.

1. Cleaning.

- a. Clean all sanitary sewers and storm sewers by flushing with high pressure water and removing debris by vacuum extraction, and by removing sheeting, bracing, shoring, forms, soil sediment, concrete, or other debris.
- b. Do not discharge soil sediment or debris to drainage channels, existing storm sewers, or existing sanitary sewer systems.

2. Visual Inspection.

- a. Check each section of sanitary sewer and storm sewer by lamping.
- b. Light should be visible through section of pipe lamped.
- c. Visually inspect each run of pipe.
- d. Repair or replace defective pipe or joints, or remove and relay pipe not meeting alignment tolerances, as directed by the Engineer.

3. Video Inspection.

a. General.

- 1) Conduct video inspection of all new and rehabilitated sanitary sewers after all backfill and compaction operations are completed, but prior to paving.
- 2) Notify the Engineer the day prior to inspection so the Engineer may be present during the inspection.
- 3) Low spots holding water in excess of 1 inch (25 mm) or 5% of the pipe diameter, whichever is less, will be considered unacceptable.
- 4) If unacceptable low spots exist, as indicated by standing water during video inspection, remove and replace sewer as necessary and re-inspect.

b. Inspection Procedure.

- 1) Prior to video inspection, run sufficient water through the pipe to saturate potential low spots so they may be detected during inspection.
- 2) Inspect each pipe segment between manholes or access points in a single, continuous run. Progress through the entire project in a uniform direction.
- 3) Inspect all lateral connections and other observations at right angles utilizing the pan and tilt capabilities of the camera.
- 4) Center the video camera in the pipe during the inspection.
- 5) Do not exceed 30 feet (10 m) of inspection per minute.

c. Inspection Reporting.

- 1) Provide a copy of the video inspection in the recording media specified by the Engineer. Include on screen continuous footage, pipe diameter, direction of viewing, and manhole and street location references in the recording. Affix labels to the recording media to include the name of the project, the date, and the location of the inspection.
- 2) Provide a written report of the inspection. In the report, include true to scale drawings of all sewer defects and observation locations. Reference the time stamp on each line item entry on the written report.

4. Sanitary Sewer Leakage Testing.

Perform one or more of the following tests on new sanitary sewer gravity mains and sanitary sewer service stubs. Test sanitary sewer manholes separately as specified in [Section 2435](#).

a. Sanitary Sewer Infiltration Testing.

- 1) Use only where ground water is more than 2 feet (600 mm) above top of pipe at highest point in section being tested.
- 2) Provide documented verification of ground water elevations for no less than 24 hours before measurement of infiltration.
- 3) Measure infiltration in sanitary sewer with a V-notch weir in downstream manhole.
- 4) The maximum allowable infiltration for new sanitary sewers, including manholes, is 200 gallons per inch of diameter per mile (19 L per mm of diameter per km) of pipe per day.

b. Sanitary Sewer Exfiltration Testing.

1) General.

Use an exfiltration test when ground water level is less than 2 feet (600 mm) above top of pipe at highest point in section being tested. Sectionalize the test section so that the internal pressure in the pipe does not exceed 5 feet (1.5 m) of water.

2) Test Procedures.

- a) Install a watertight plug in the inlet of the upstream and downstream manhole of sewer section being tested.
- b) Fill the sewer and upstream manhole with potable water until the water elevation in the upstream manhole is 2 feet (600 mm) higher than outside top of pipe in section being tested or 2 feet (600 mm) above existing ground water level, whichever is highest elevation.
- c) Allow the water level to stabilize for 30 minutes, then refill the upstream manhole with water to the original level and begin the test.
- d) Measure the amount of water lost in the upstream manhole in 1 hour. Use that amount to determine exfiltration in a 24 hour period.

3) Exfiltration Rate.

- a) Table 2504.03-1 may be used to determine exfiltration in gallons (liters) per 24 hours by measuring the loss that occurs in 1 hour. The table is applicable only for 48 inch (1200 mm) diameter manholes.
- b) The maximum allowable exfiltration for new sanitary sewer, including manholes, is 200 gallons per inch of diameter per mile (19 L per mm of diameter per km) of pipe per day.

Table 2504.03-1: Loss in Gallons (Liters) Per 24 Hours for Drop in Water Level per Hour in 48 inch (1200 mm) Diameter Manhole (table may be interpolated to the nearest 1/4" (6 mm) drop)

Drop	0"	1"	2"	3"	4"	5"	6"	7"	8"	9"
	0	188	376	564	752	940	1128	1316	1504	1692
Drop	0 mm	25 mm	50 mm	75 mm	100 mm	125 mm	150 mm	175 mm	200 mm	225 mm
	0	712	1423	2135	2845	3558	4267	4982	5693	6405

- c) For manholes larger than 48 inch (1200 mm) diameter, use the following formula:

English

$$G = 0.0816(H)(D^2)$$

Where:

G = loss in gallons

D = diameter of manhole in inches

H = water level drop in manhole in inches

Metric

$$L = 353.25(H)(D^2)$$

Where:

L = loss in liters

D = diameter of manhole in mm

H = water level drop in manhole in mm

c. Sanitary Sewer Low Pressure Air Testing.

1) General.

- a) A low pressure air test may be used in lieu of an exfiltration test except as noted.
- b) Air test is not recommended when ground water elevation is 2 feet (600 mm) or greater above the top of the pipe, and cannot be used when ground water is greater than 6 feet (2 m) above the top of the pipe.
- c) Use extreme care and follow safety precautions during testing operations. No one is allowed in manholes during testing.

2) Test Procedures.

- a) Clean the entire line of all debris. Flush or wet line to produce consistent results.
- b) Plug all inlets and outlets to resist the test pressure. Special attention shall be given to stoppers and laterals.
- c) Determine the test duration for the section being tested from Table 2504.03-2. This table ignores pipe length and uses the factor $0.472 \times d$ ($1.20 \times d$), with d being

in inches (mm). Pressure holding time is based on average holding pressure of 3.0 psi (21 kPa) or drop from 3.5 psi (24 kPa) to 2.5 psi (18 kPa).

Table 2504.03-2: Test Duration

Size Pipe, inches (mm)	Test Period Duration (minutes)
8 (200)	4.0
10 (250)	5.0
12 (300)	6.0
15 (325)	7.0
18 (450)	8.5
21 (525)	10.0
24 (600)	11.5
27 (675)	13.0
30 (750)	14.0
36 (900)	17.0
42 (1050)	20.0
48 (1200)	23.0
54 (1350)	25.5
60 (1500)	28.5

- d) Add air to the line segment being tested until the internal air pressure of the sewer line is raised to approximately 4.0 psi (28 kPa) greater than the average back pressure of any ground water that may be over the top of the pipe. Pressure in the sewer should not exceed 5.0 psi (35 kPa). Allow at least 2 minutes for air pressure to stabilize.
 - e) When pressure has stabilized and is at or above the starting test pressure of 3.5 psi (24 kPa), commence the test. Record the drop in pressure for the test period. The test may be discontinued when the prescribed test time has been completed, even though a 1.0 psi (7 kPa) drop has not occurred.
 - f) If groundwater level at the time of testing is above the pipe invert, add 0.43 psi air per foot (10 kPa air per meter) of water above the invert to the test air pressure range of 2.5 psi (18 kPa) to 3.5 psi (24 kPa) stated above.
 - g) If the pressure drop exceeds 1.0 psi (7 kPa) during the test period, the test will be considered to have failed. Repair and retest the line.
- d. **Sanitary Sewer Vacuum Testing.**
- 1) **General.**
 - a) Vacuum testing may be used in lieu of other specified test methods.
 - b) Use extreme care and follow safety precautions during testing operations. Keep personnel out of and away from manholes during testing.
 - c) Where practical, clean the pipe prior to testing and wet the pipe surface. Isolate the test segment as necessary, including closing service connections.
 - 2) **Test Procedures.**
 - a) Determine the test time for the size of pipe being tested using Table 2504.03-3.

Table 2504.03-3: Minimum Test Time

Nominal Pipe Size, inches (mm)	T (time); Minutes/100 feet (30 m) of pipe
4 (100)	0.3
6 (150)	0.7
8 (200)	1.2
10 (250)	1.5
12 (300)	1.8
15 (375)	2.1
18 (450)	2.4
21 (525)	3.0
24 (600)	3.6
27 (675)	4.2
30 (750)	4.8
33 (825)	5.4
36 (900)	6.0

- b)** Test time is the time required for vacuum to drop from 3.5 psi (24 kPa) to 2.5 psi (18 kPa).
- c)** Use a vacuum pump with the capacity to evacuate the sewer test section in time equal or less than that shown in Table 2504.03-3 for the size of pipe being tested.
- d)** Evacuate air until the internal air pressure of the sewer line is lowered by approximately 4.0 psi (28 kPa). Allow the air pressure to stabilize.
- e)** When the air pressure is stabilized near the starting test vacuum of 3.5 psi (24 kPa), commence the test by allowing gage pressure to drop to 3.5 psi (24 kPa), then commence time recording. Record the drop in vacuum for the test period.
- f)** If the drop in vacuum is 1.0 psi (7.0 kPa) or less during the test period, the test will be considered successfully passed.
- g)** If the drop in vacuum is greater than 1.0 psi (7.0 kPa) during the test period, inspect, evaluate, repair, and retest.

5. Deflection Testing.

- a.** Perform deflection tests on all PVC sanitary sewer mains. Also perform deflection tests on all HDPE storm sewer or culvert pipe 12 inches in diameter or greater.
- b.** Perform deflection tests after backfill material has been in place at least 30 calendar days and before paving activity takes place, or as per appropriate sections of these specifications.
- c.** Pull a 9 arm deflection mandrel complying with applicable ASTM Standards through sewer by hand.
- d.** Ensure pipe deflection does not exceed 5% of average inside diameter as established by ASTM Standards.
- e.** Remove and replace pipe exceeding deflection limits.
- f.** Handle and divert existing flows during deflection testing.

6. Force Main Testing.

- a.** Provide test pumps, test plugs, pipe, and gages. Make necessary piping connections.
- b.** Fill the force main with potable water and flush before testing to remove entrapped air. Other water sources may be used if approved by the Engineer.
- c.** Insert taps as required to remove air. Plug taps after the completion of tests.
- d.** Use a test pressure of 1.5 times the working pressure at the lowest point along the test section, but no less than 50 psi (350 kPa).
- e.** Pressurize the test section and allow it to stabilize prior to beginning the leakage test.
- f.** Maintain pressure to within 5 psi (35 kPa) of the test pressure by pumping in potable water as required.
- g.** Leakage is the quantity of water that shall be supplied into the test section to maintain pressure within 5 psi (35 kPa) of the specified test pressure during a 2 hour test period.

- h. The maximum allowable leakage is determined by the following formula:

English Units

$$L = \frac{(S)(D)(P)^{0.5}}{133,200}$$

Where:

L = allowable leakage in gallons per hour
S = length of pipe tested in feet
D = nominal pipe diameter in inches
P = average test pressure in pounds per square inch

Metric Units

$$L = \frac{(S)(D)(P)^{0.5}}{705,150}$$

Where:

L = allowable leakage in liters per hour
S = length of pipe tested in meters
D = nominal pipe diameter in mm
P = average test pressure in kPa

Table 2504.03-4 assumes an average test pressure (P) of 50 psi (350 kPa) and length of pipe (S) of 1000 feet (300 m).

Table 2504.03-4: Maximum Allowable Leakage Rate

Nominal Pipe Size inches (mm)	Allowable Leakage gallons/hour/1000 feet of pipe (liters/hour/300 m of pipe)
4 (100)	0.21 (0.80)
6 (150)	0.32 (1.19)
8 (200)	0.42 (1.59)
10 (250)	0.53 (1.99)
12 (300)	0.64 (2.39)
14 (350)	0.74 (2.79)
16 (400)	0.85 (3.18)

- i. Examine exposed pipe and fittings during testing. Repair all visible leaks.
- j. If the test indicates leakage greater than allowed, locate, repair, or replace damaged or defective pipe, and repeat tests until the requirements are met.

2504.04 METHOD OF MEASUREMENT.

A. Sanitary Sewer Gravity Main.

1. Trenched.

Measurement for each type and size of pipe installed in a trench will be in linear feet (meters) along the centerline of the pipe from center of manhole to center of manhole.

2. Trenchless.

Measurement for each type and size of pipe installed by trenchless methods will be in linear feet (meters) along the centerline of pipe.

B. Sanitary Sewer Gravity Main with Casing Pipe.

1. Trenched.

Measurement for each type and size of pipe installed with casing pipe in a trench will be in linear feet (meters) along the centerline of the casing pipe from end of casing to end of casing.

2. Trenchless.

Measurement for each type and size of pipe installed by trenchless methods with a casing pipe will be in linear feet (meters) along the centerline of the casing pipe from end of casing to end of casing.

C. Sanitary Sewer Force Main.

1. Trenched.

Measurement for each type and size of pipe installed in a trench will be in linear feet (meters) along the centerline of the pipe from the outside wall of the pumping station to the center of manhole, or from center of manhole to center of manhole.

2. Trenchless.

Measurement for each type and size of pipe installed by trenchless methods will be in linear feet (meters) along centerline of pipe.

D. Sanitary Sewer Force Main with Casing Pipe.

1. Trenched.

Measurement for each type and size of pipe installed with casing pipe in a trench will be in linear feet (meters) along the centerline of the casing pipe.

2. Trenchless.

Measurement for each type and size of pipe installed by trenchless methods with a casing pipe will be in linear feet (meters) along the centerline of the casing pipe.

E. Sanitary Sewer Service Stub.

1. A sanitary sewer service stub is the portion of the sanitary sewer service from the main to a point 10 feet (3 m) outside of the right-of-way line or as specified in the contract documents.
2. Measurement for each type and size of pipe will be in linear feet (meters) along the centerline of the pipe from the end of the pipe to the centerline of the sewer main.

F. Sanitary Sewer Service Relocation.

1. A sanitary sewer service relocation is the portion of an existing sanitary sewer service in a zone of conflict.
2. Each completed relocation will be counted.

G. Sewage Air Release Valve and Pit.

Each completed installation, including valve, accessories, and pit, will be counted.

H. Removal of Sanitary Sewer.

Measurement for each type and size of pipe removed will be in linear feet (meters) from end to end.

I. Cleaning, Inspecting, and Testing.

None.

2504.05 BASIS OF PAYMENT.

A. Sanitary Sewer Gravity Main.

1. Trenched.

- a. Payment will be at the contract unit price per linear foot (meter) for each type and size of pipe.
- b. Payment is full compensation for trench excavation, dewatering, furnishing bedding material, placing bedding and backfill material, wyes and other fittings, pipe joints, testing, and inspection.

2. Trenchless.

- a. Payment will be at the contract unit price per linear foot (meter) for each type and size of pipe.
- b. Payment is full compensation for:
 - Furnishing and installing pipe,
 - Trenchless installation materials and equipment,
 - Pit excavation, dewatering, and placing backfill material,
 - Pipe connections, and
 - Testing and inspection.

B. Sanitary Sewer Gravity Main with Casing Pipe.

1. Trenched.

- a. Payment will be at the contract unit price per linear foot (meter) for each type and size of sanitary sewer pipe.
- b. Payment is full compensation for:
 - Furnishing and installing both sanitary sewer pipe and casing pipe,
 - Trench excavation, dewatering, furnishing bedding material, placing bedding and backfill material,
 - Furnishing and installing annular space fill material,
 - Casing spacers,
 - Pipe connections, and
 - Testing, and inspection.

2. Trenchless.

- a. Payment will be at the contract unit price per linear foot (meter) for each type and size of sanitary sewer pipe.
- b. Payment is full compensation for:
 - Furnishing and installing both sanitary sewer pipe and casing pipe,
 - Trenchless installation materials and equipment,
 - Pit excavation, dewatering, and placing backfill material,
 - Casing spacers,
 - Furnishing and installing annular space fill material,
 - Pipe connections, and
 - Testing and inspection.

C. Sanitary Sewer Force Main.

1. Trenched.

- a. Payment will be at the contract unit price per linear foot (meter) for each type and size of pipe.
- b. Payment is full compensation for trench excavation, dewatering, furnishing bedding material, placing bedding and backfill material, wyes and other fittings, pipe joints, testing, and inspection.

2. Trenchless.

- a. Payment will be at the contract unit price per linear foot (meter) for each type and size of pipe.
- b. Payment is full compensation for furnishing and installing pipe, trenchless installation materials and equipment, pit excavation, dewatering, placing backfill material, pipe connections, testing, and inspection.

D. Sanitary Sewer Force Main with Casing Pipe.

1. Trenched.

- a. Payment will be at the contract unit price per linear foot (meter) for each type and size of sanitary sewer pipe.
- b. Payment is full compensation for furnishing and installing both sanitary sewer pipe and casing pipe, trench excavation, dewatering, placing bedding and backfill material, furnishing and installing annular space fill material, casing spacers, pipe connections, testing, and inspection.

2. Trenchless.

- a. Payment will be at the contract unit price per linear foot (meter) for each type and size of sanitary sewer pipe.
- b. Payment is full compensation for:
 - Furnishing and installing both sanitary sewer pipe and casing pipe,
 - Trenchless installation materials and equipment,
 - Pit excavation, dewatering, and placing backfill material,
 - Casing spacers,
 - Furnishing and installing annular space fill material,
 - Pipe connections, and
 - Testing and inspection.

E. Sanitary Sewer Service Stub.

1. Payment will be made at the contract unit price per linear foot (meter) for each type and size of sanitary sewer service stub.
2. Payment is full compensation for trench excavation, furnishing bedding material, placing bedding and backfill material, tap, fittings, testing, and inspection.

F. Sanitary Sewer Service Relocation.

1. Payment will be made at the contract unit price for each relocation.
2. Payment is full compensation for removal of existing pipe, trench excavation, furnishing new pipe and bedding material, placing bedding and backfill material, connection back to existing service, compaction, testing, and inspection.

G. Sewage Air Release Valve and Pit.

1. Payment will be made at the contract unit price for each sewage air release valve and pit.
2. Payment is full compensation for excavation, furnishing bedding material, placing bedding and backfill material, compaction, and testing.

H. Removal of Sanitary Sewer.

1. Payment will be at the contract unit price per linear foot (meter) for each type and size of pipe.
2. Payment is full compensation for removal, disposal, and capping (if specified) of pipe.

I. Cleaning, Inspecting, and Testing.

Cleaning, inspecting, and testing sanitary sewers, storm sewers, pipe culverts, and rehabilitated pipes (including video inspection) is incidental to other project costs and will not be paid for separately.