

Section 02531

GRAVITY SANITARY SEWERS

PART 1 GENERAL

1.01 SUMMARY

This Section includes gravity sanitary sewers and appurtenances, sanitary and process drains, including stacks and service connections.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for gravity sanitary sewers by open-cut or within Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis, complete in place, including sewer pipe, connections to existing manholes, and post installation television inspection and testing. Measurement will be taken along centerline of pipe from centerline to centerline of manholes.
2. No separate payment is to be made for pavement removal and replacement for augering, tunneling, or other trenchless methods of installation unless otherwise shown on Plans.
3. No separate payment is to be made for diversion pumping.
4. Refer to Section 01270 - "Measurement and Payment" for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A. This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. ASTM D3034: Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- C. ASTM F1417 Rev A: Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air
- D. TCEQ Chapter 217 Sub-Chapter C: Conventional Collection Systems

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01330 – “Submittal Procedures:”
- B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- C. Test Reports:

Submit test reports and inspection videos as specified in Part 3 of this Section. All video recordings become property of the Owner.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01555 - "Traffic Control and Regulation."
- D. Section 01578 – “Control of Ground Water and Surface Water”
- E. Section 02081 – “Cast-in-Place Concrete Manholes”
- F. Section 02082 – “Precast Concrete Manholes”
- G. Section 02084 – “Frames, Grates, Rings, and Covers”
- H. Section 02221 – “Removing Existing Pavements and Structures”
- I. Section 02260 – “Trench Safety System”
- J. Section 02317 – “Excavation and Backfill for Utilities”
- K. Section 02320 – “Utility Backfill Materials”
- L. Section 02321 – “Cement Stabilized Sand”
- M. Section 02501 – “Ductile Iron Pipe and Fittings”
- N. Section 02506 – “Polyvinyl Chloride Pipe”
- O. Section 02911 – “Topsoil”
- P. Section 02921 – “Hydromulch Seeding”
- Q. Section 02922 – “Sodding”

R. Section 02951 – “Pavement Repair and Resurfacing”

S. Section 15064 – “Polyvinyl Chloride Pipe Less than 4” In Diameter”

1.06 QUALITY ASSURANCE

A. Qualifications:

B. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe to-manhole connections.

C. Regulatory Requirements

1. Install sewer lines in accordance with TCEQ Chapter 217 Sub-chapter C: Conventional Collection Systems.

1.07 PROJECT DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

A. Inspect pipe and fittings upon arrival of materials at job site.

B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.

C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

1.09 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Pipe

1. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Plans or as specified.

2. Unlined reinforced concrete pipe is not acceptable.

B. Pipe Material Schedule

1. Unless otherwise shown on Plans, use pipe materials that conform to requirements specified in one or more of following Sections:
 - a. Ductile Iron Pipe: See Section 02501 - "Ductile Iron Pipe and Fittings."
 - b. Polyvinyl Chloride Pipe: See Section 02506 - "Polyvinyl Chloride Pipe" and 15064 - "Polyvinyl Chloride Pipe Less than 4" In Diameter."
2. Where shown on Plans, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.
3. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

C. Appurtenances

1. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

D. Bedding, Backfill, and Topsoil Material

1. Bedding and Backfill:

Conform to requirements of Section 02317 - "Excavation and Backfill for Utilities", Section 02320 - "Utility Backfill Materials", and Section 02321 - "Cement Stabilized Sand."
2. Topsoil:

Conform to requirements of Section 02911 - "Topsoil".

2.03 - 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Unless otherwise included in Plans, prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Section 01555 - "Traffic Control and Regulation."
- B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Section 01555 - "Traffic Control and Regulation."

Maintain barricades and warning lights where Work is in progress or where traffic is affected by Work.

- C. Perform Work in accordance with OSHA standards. Employ trench safety system as specified in Section 02260 – “Trench Safety System” for excavations over 5 feet deep.
- D. Immediately notify Project Manager and agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from Project Manager and agency or utility company for repairs or relocations, either temporary or permanent.
- E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Section 02221 – “Removing Existing Pavements and Structures.”
- F. Install and operate dewatering and surface water control measures in accordance with Section 01578 – “Control of Ground Water and Surface Water.”
- G. Do not allow sand, debris or runoff to enter sewer system.
- H. Make notification to Project Manager when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.
- I. Lay gravity sewer lines in straight alignment and grade.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Diversion Pumping
 - 1. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from appropriate owner/agency through the Project Manager.
 - 2. Design piping, joints and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.
 - 3. No sewage shall be diverted into area outside of sanitary sewer.
 - 4. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify Project Manager and Engineer so that required reporting can be made to the Texas Commission on Environmental Quality (TCEQ) by Project Manager.

B. Excavation

1. Earthwork:

Conform to requirements of Section 02317 – “Excavation and Backfill for Utilities.” Use bedding as indicated on Plans.

2. Line and Grade:

Establish required uniform line and grade in trench from benchmarks identified by Engineer. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.

3. Trench Excavation:

Excavate pipe trenches to depths shown on Plans and as specified in Section 02317 – “Excavation and Backfill for Utilities.”

C. Pipe Installation by Open Cut

1. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

2. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Engineer.

3. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.

4. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.

5. Form concentric joint with each section of adjoining pipe so as to prevent offsets.

6. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe

7. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment shall not be allowed unless protective measures are provided and approved in advance by Engineer.

8. Keep excavations free of water during construction and until final inspection.
9. When Work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.
10. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

D. Pipe Installation Other Than Open Cut

For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification sections on tunneling, augering, jacking, and microtunneling work as appropriate.

E. Installation of Appurtenances

Construct manholes to conform to requirements of Section 02081 – “Cast-in-Place Concrete Manholes” and Section 02082 – “Precast Concrete Manholes,” as applicable. Install frames, rings, and covers to conform to requirements of Section 02084 – “Frames, Grates, Rings, and Covers.”

F. Inspection and Testing

1. Visual Inspection:

Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and relay or replace pipe segment.

2. Mandrel Testing:

- a. Use Mandrel Test to test flexible pipe greater than 6" in diameter for deflection. Testing of flexible pipe less than 6" in diameter will be per direction of the Owner or Engineer.
- b. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
- c. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.
- d. Retest repaired or replaced sewer sections.

3. Pipe Leakage Test:

After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage with low pressure air testing. Maintain piezometer, installed to conform to Section 01578 – “Control of Ground Water and Surface Water,” to determine groundwater pressure on pipe, and until acceptance testing is completed.

- a. Contractor to supply all equipment necessary to perform testing including but not limited to control panel, low pressure air supply, air hoses, pressure gauges, and pneumatic plugs. Plugs are acceptable when they remain in place against test pressure without external aids.
- b. Immediately before performing line leakage test use piezometer to measure height in feet of water over invert of pipe. Divide this height by 2.3 feet/psi to determine ground water pressure to be used in testing.
- c. Low Pressure Air test must follow and conform to ASTM F1417 as applicable except as to testing times as required in this section.
- d. Low Pressure Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
- e. Pressurize pipe to 3.5 psi greater than pressure exerted by groundwater on the pipe as determined in “b.” above.
- f. Once the pressure is stabilized, the minimum time allowable for the pressure to drop from 3.5 psig to 2.5 psig (taking ground water pressure into account) is computed from the following equation from TCEQ Chapter 217 Sub-Chapter C - 217.57.

$$T = (0.0850 \times D \times K) / (Q)$$

where: T = time for pressure to drop 1.0 pounds per square inch gauge in seconds

K = 0.000419 D x L, but not less than 1.0

D = average inside diameter in inches

L = length of line of same pipe size in feet

Q = rate of loss, 0.0015 ft³/min./sq. ft. internal surface

- g. Since a K value of less than 1.0 may not be used, the minimum testing times allowable for each pipe diameter is shown in the following Table.

In addition, the maximum length of pipe tested for minimum time, and the time longer per foot of length is also provided.

Pipe Diameter (inches)	Minimum Time (seconds)	Maximum Length for Minimum Time (feet)	Time for Longer Length (seconds/foot)
6	340	398	0.855
8	454	298	1.520
10	567	239	2.374
12	680	199	3.419
15	850	159	5.342
18	1020	133	7.693
21	1190	114	10.471
24	1360	100	13.676
27	1530	88	17.309
30	1700	80	21.369
33	1870	72	25.856

- h. If a shorter length of pipe than in the above table is required to be tested, the minimum allowable time for that diameter in the table above shall be used as the minimum allowable time for that section of pipe.
- i. If pressure drops from 3.5 psig to 2.5 psig as stated above in a time less than the required minimum allowable time, repair and retest that section of pipe.

G. Backfill and Site Cleanup

1. Backfill and compact soil in accordance with Section 02317 – “Excavation and Backfill for Utilities.”
2. Backfill trench in specified lifts only after pipe installation is approved by Engineer.
3. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Section 02951 – “Pavement Repair and Resurfacing.”
4. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Plans. Provide minimum of 4 inches of topsoil as specified in Section 02911 – “Topsoil” and apply hydromulch according to requirements of Section 02921 – “Hydromulch Seeding.”

5. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Plans. Provide minimum of 4 inches of topsoil per Section 02911 – “Topsoil.” Sod disturbed areas in accordance with Section 02922 – “Sodding.”

3.04 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

A. Post-Installation Television Inspection

1. Television inspection shall only be required as called for in Contract Documents and per the Plans for piping located within the facility. Television inspection will be required for any lines installed in a Right-Of-Way (ROW) or connecting directly to a main sanitary sewer line located in a ROW.
2. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles (3,000 psi) and collection, removal, transportation and disposal of sand, debris, and liquid wastes to legal disposal sites.
3. Select and use closed-circuit television equipment that will produce color videos.
4. Produce videos using pan-and-tilt, radial viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use camera with accurate footage counter which displays on monitor exact distance of camera from starting manhole. Use camera with camera height adjustment so that camera lens is always centered at one-half inside diameter, or higher, in pipe being televised. Provide lighting system that allows features and condition of pipe to be clearly seen. Reflector in front of camera may be necessary to enhance lighting in dark or large diameter pipe.
5. Perform television inspection of gravity sanitary sewers as follows:
 - a. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and where sewer transitions from one pipe material to another.
 - b. Videos shall be continuous for pipe segments between manholes. Do not leave gaps in video taping of segment between manholes and do not show single segment on more than one video tape.

- c. No flow is allowed in gravity sanitary sewer while performing post-installation television inspection.
- 6. Provide videos in DVD format, recorded at Standard Play (SP). Two labels are required. Place one label on DVD case and other on face of each DVD. Permanently label each DVD and Case with following information.

DVD Case

Project No.: _____	Contractor's Name: _____
Inspection Type: <input type="checkbox"/> Survey <input type="checkbox"/> Pre-Installation <input type="checkbox"/> Post-Installation	
DVD No.: _____	Date Televised: _____ Date Submitted: _____
Basin No: _____	

Face of DVD

DVD No.: _____		Date Televised: _____		Date Submitted: _____
Manhole No. From	Manhole No. To	Pipe Diameter	Pipe Length	Street
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

- 7. For each DVD provide completed TV Inspection Report. The TV Inspection Report is a written/narrated log of pipe conditions and service connections, indexed to footage counter.
- 8. Upon completion of DVD reviews by Engineer, Contractor will be notified regarding final acceptance of sewer segment.

3.09 – 3.10 NOT USED

END OF SECTION