

DESIGN STANDARDS FOR SANITARY SEWER SYSTEMS

1.0 GENERAL: The following sanitary sewer planning standards are based on Federal, State and local health requirements and engineering design criteria. In general, the 'Ten States Standards' shall apply where applicable.

1.0.1 **Applicability:** These criteria shall apply to all developments including but not limited to residential, commercial, institutional and industrial developments, subdivisions, parks and/or recreational areas desiring sewer service from the Lexington County Joint Municipal Water and Sewer Commission (the Commission).

1.0.2 **General Design Parameters:**

- a. Plans for new systems, extensions to new areas or replacement sanitary sewers will be approved only when designed according to the "separate plan", in which rainwater from roofs, streets and other areas, and groundwater from foundation drains, are excluded.
- b. Sewers shall not be constructed under street paving except for crossings. Variations must be approved in writing from the Commission.

1.0.3 **Design Capacity:**

- a. Sewer systems should be designed for the estimated ultimate tributary population, except in considering parts of the system that can be readily increased in capacity. Similarly, consideration should be given to the maximum anticipated capacity of institutions, industrial parks, and other potential land uses within the planning area.
- b. Sewer systems proposed to serve either a drainage basin of more than 375 acres or a pipe size of 15 inches, whichever is greater, must be adequately designed to handle the effluent at the ultimate landholding capability. Downstream from this point, design based on the Central Midlands Regional Planning Council's 20-year projected population figures will be acceptable, provided adequate easements are furnished to provide for future installation of parallel lines. Additionally, where at least 30 percent of a drainage area is already developed, a population density at least equal to that of the existing development must be used for the entire drainage area.

1.0.4 **Design Flow:**

- a. In general, new sewer systems shall be designed on the basis of an average daily per capita flow of sewer of not less than 100 gallons per day. This figure is assumed to cover normal infiltration, but an additional allowance should be made where conditions are unfavorable.
- b. An equivalent residential unit (one tap) is defined to be 300 gallons per day.
- c. For other than single family residential areas, the anticipated design flow shall be computed according to the guidelines for unit contributory

loadings as established by the South Carolina Department of Health and Environmental Control.

- d. A minimum peaking factor of 2.5 shall be applied to the average daily flows as determined above.

1.0.5 Easement: Easement for gravity mains (8" to 24") are to be provided as follows:

- a. 0' - 7' depth - 15' easement width
- b. 7' - 12' depth - 25' easement width
- c. 12' - 15' depth - 30' easement width

For depths greater than shown above, gravity mains larger than 24" or unusual ground/site conditions, the easement width shall be reviewed by the Commission on a case by case basis.

2.0 DETAILS OF DESIGN AND CONSTRUCTION

2.0.1 Minimum Size: No public gravity sewer conveying raw wastewater shall be less than 8 inches in diameter.

2.0.2 Depth: In general, sewers should be sufficiently deep to receive wastewater from basements and to prevent freezing. Sanitary sewers shall have a minimum cover of three feet between manholes. They may be encased or constructed of cast iron if this depth cannot be achieved, but only upon written approval of the Commission.

2.0.3 Buoyancy: Buoyancy of sewers shall be considered and flotation of the pipe shall be prevented with appropriate construction where high groundwater conditions are anticipated.

2.0.4 Slope:

- a. All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula using an "n" value of 0.013. The following are the minimum slopes which should be provided; however, slopes greater than these are desirable.

| <u>Sewer Diameter</u> <u>(inches)</u> | <u>Minimum Slope</u> <u>(Feet Per 100 Feet)</u> |
|--|--|
| 8 | 0.40 |
| 10 | 0.28 |
| 12 | 0.22 |
| 15 | 0.15 |
| 16 | 0.14 |
| 18 | 0.12 |
| 21 | 0.10 |
| 24 | 0.08 |
| 27 | 0.067 |
| 30 | 0.058 |

36
42

0.046
0.037

- b. Slopes slightly less than those required for the 2.0 feet per second velocity, when flowing full, may be permitted. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow.
- c. Sewers shall be laid with uniform slope between manholes.
- d. Where velocities greater than 15 feet per second are attained, special provision shall be made to protect against displacement by erosion and impact.
- e. Sewers on 20 percent slopes or greater shall be anchored securely with concrete, or equal, anchors spaced as follows:
 - 1. Not over 36 feet center to center on grades 20 percent and up to 35 percent;
 - 2. Not over 24 feet center to center on grades 35 percent and up to 50 percent; and
 - 3. Not over 16 feet center to center on grades 50 percent and over.

2.0.5 Alignment: In general, sewers 24 inches or less shall be laid with straight alignment between manholes.

2.0.6 Changes in Pipe Size: When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

2.0.7 Materials:

- a. The materials selected for sewers should be adapted to local conditions, such as: character of industrial wastes, possibility of septicity, soil characteristics, exceptionally heavy external loadings, abrasion, corrosion, and similar problems. Suitable couplings complying with ASTM specifications shall be used for joining dissimilar materials.
- b. All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads shall be made based on the width and depth of trench. Where necessary, special bedding, haunching and initial backfill, concrete cradle, or other special construction shall be used to withstand anticipated potential superimposed loading or loss of trench wall stability.

2.0.8 Joints and Infiltration:

- a. The method of making joints and the materials used shall be included in the specifications. Sewer joints shall be designed to minimize infiltration and to prevent the entrance of roots.

- b. Leakage tests shall be conducted utilizing the low pressure air method. The air test shall conform to the test procedure described in the ASTM standard pertaining to the material selected. Other testing procedures may be submitted for review to the Commission.

3.0 MANHOLES

- 3.0.1 Location: Manholes shall be installed: at the end of each line; at all changes in grade, size or alignment; at all intersections; and at distances not greater than 400 feet for sewers 15 inches or less, and 500 feet for sewers 18 inches to 30 inches. Greater spacing may be permitted in larger sewers. Cleanouts may be used only for special conditions and shall not be substituted for manholes nor installed at the end of laterals greater than 150 feet in length.
- 3.0.2 Drop Type: A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.
- 3.0.3 Diameter: The minimum diameter of manholes shall be 48 inches; larger diameters are preferable. For sewers in sizes eight inches up to 15 inches, manholes are to be a minimum of four feet in diameter. For sewers 18 inches and larger, manholes are to be a minimum of five feet in diameter and larger.
- 3.0.4 Depth:
 - a. The four-foot diameter manhole shall have a minimum depth of two (2) feet measured from the top of the pipe to the top of the ring. Manholes of larger diameter shall be proportionally deeper. This provides for proper corbel construction.
 - b. Where conditions preclude achieving the minimum depths described above, a special shallow manhole may be provided, upon written approval of the Commission.
 - c. Manhole rings shall be flush with the final grade when located within the traveled way; otherwise, the ring shall be 0.1 foot above final grade within SCDOT Right-of-Way and 0.5 feet in dedicated easements.
- 3.0.5 Flow Channel: The flow channel through manholes should be made to conform in shape and slope to that of the connecting sewers.
- 3.0.6 Watertightness: Watertight manhole covers are to be used wherever the manhole tops may be flooded by street runoff or high water.

4.0 SEWERS IN RELATION TO STREAMS

- 4.0.1 Cover Depth: The top of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. In general, the following cover requirements must be met'.
 - a. One foot of cover where the sewer is located in rock;

- b. Three feet of cover in other material. In major streams, more than three feet of cover may be required; and
 - c. In paved stream channels, the top of the sewer line should be placed below the bottom of the channel pavement.
- 4.0.2 Horizontal Location: Sewers located along streams shall be located outside of the streambed and sufficiently removed therefrom to provide for future possible stream widening and to prevent pollution by siltation during construction.
- 4.0.3 Structures: The sewer outfalls, headwalls, manholes, gate boxes, or other structures shall be located so they do not interfere with the free discharge of flood flows of the stream.
- 4.0.4 Alignment: Sewers crossing streams should be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade. Sewer systems shall be designed to minimize the number of stream crossings.
- 4.0.5 Materials: Sewers entering or crossing streams shall be constructed of ductile iron pipe with mechanical joints.

5.0 AERIAL CROSSINGS

- 5.0.1 Pipe Support: Support shall be provided for all joints in pipes utilized for aerial crossings. The supports shall be designed to prevent frost heave, overturning, and settlement.
- 5.0.2 Elevation: For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe should be placed no lower than the elevation of the 100-year flood. Ductile iron pipe with mechanical joints is required.

6.0 PROTECTION OF WATER SUPPLIES

- 6.0.1 Cross-connections Prohibited: There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenance thereto, which would permit the passage of any wastewater or polluted water into the potable supply. No water pipe shall pass through or come into contact with any part of a sewer manhole.
- 6.0.2 Relation to Waterworks Structures:
- a. Sewers shall meet the requirements of the South Carolina Department of Health and Environmental Control with respect to minimum distances from public water supply wells or other water supply sources and structures.
 - b. All existing waterworks units, such as basins, wells or other treatment units, within 200 feet of the proposed sewer, shall be shown on the engineering plans.

7.0 RELATION TO WATER MAINS

7.0.1 Horizontal and Vertical Separation:

- a. Sewers shall be laid at least 10 feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot lateral separation, the sewer may be laid closer to a water main provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18 inches above the top of the sewer.
- b. If it is impossible to obtain proper horizontal and vertical separation as described above, the sewer must be constructed conforming to water supply design standards and be pressure tested to 150 psi to ensure watertightness before backfilling.

7.0.2 Crossings:

- a. Sewers crossing water mains shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and outside of the sewer. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to maintain line and grade.
- b. When it is impossible to obtain a vertical separation of 18 inches, one of the following methods must be specified to effect the crossing:
 1. The sewer shall be designed and constructed equal to water pipe, and shall be pressure tested to 150 psi to ensure watertightness prior to backfilling.
 2. Either the water main or the sewer line may be encased in a watertight carrier pipe which extends 10 feet on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be of materials approved for use in water main construction.

8.0 SEWAGE PUMPING STATIONS

8.0.1 General: In general, pumping stations will only be approved where gravity service is not possible. The following factors must be taken into consideration with respect to location, design and construction of pumping stations:

- a. Sewage pumping stations shall not be subject to flooding, and shall be protected from damage of the 100-year return frequency storm. Pump stations shall be fully operational during flooding from the 100-year storm. A suitable superstructure located off the right-of-way of streets and alleys shall be provided. It is important that the station be readily accessible.
- b. The size of the site provided for the pumping station must be a minimum of 25 feet by 25 feet. Site size shall be determined by the Commission.

- c. The pumping station site must be fenced. Fencing must be a minimum of six feet high. A double swing gate, a minimum of 12 feet wide, must be provided.
- d. Alarm and SCADA systems must be provided for all pumping stations as required by the Commission. These systems shall be activated in cases of power failure if emergency power is not in place, pump failure, or any cause of pump station malfunction. An audio-visual device shall be installed at the station for external observation.
- e. A sign stating "In case of emergency call 359-8373" shall be furnished and attached to the fencing. The sign must be 12 inches wide by 24 inches high, with 2 1/2 inch letters.
- f. An all-weather surfaced road, a minimum of 12 feet wide, capable of supporting 36,000 pound vehicles, must be provided for access to the pumping station site. A permanent easement, a minimum of 20 feet wide, must be furnished along the access road. Access roads to remotely located stations must have a turnaround area 40 feet x 40 feet to accommodate mobile boom trucks.
- g. Provisions shall be made to facilitate removing pumps and motors.
- h. Provisions shall be made for an emergency power supply, adequate to operate all equipment at the pumping station, in accordance with Commission requirements.
- i. Where a public water supply exists nearby, a potable water supply with freeze proof hose bib and double check valve backflow prevention device must be provided at the pumping station. All fees must be paid by the developer.
- j. Sewage pumping facilities and portable equipment shall be supplied with five complete sets of operational instructions, including emergency procedures, maintenance schedules, pump curves, parts lists, tools and such spare parts as may be necessary.
- k. Application and payment of fees for the power meter shall be the responsibility of the developer. Upon acceptance of the pumping station, ownership and billing will be transferred to the Commission.

8.0.2 Design Criteria:

- a. The effective capacity of the wet well shall provide a holding period not to exceed 10 minutes for the design average flow of the drainage basin, unless otherwise approved in writing by the Commission.
- b. Pumps shall be adequately sized to handle the design peak flow of the proposed project. Pumps should be selected that have an operating point at or near peak efficiency; a minimum efficiency of 50% will be required.
- c. At least two pumps shall be installed. Where only two units are provided, they shall be of the same size. Units shall have capacity such that, with

any unit out of service, the remaining units will have capacity to handle peak sewage flows.

- d. Pumps shall be capable of passing spheres of at least three inches in diameter. Pump suction and discharge opening shall be at least four inches in diameter.
- e. Suitable shutoff and check valves, installed in a separate valve pit, shall be placed on the discharge line of each pump. The check valve shall be located between the shutoff valve and the pump.
- f. Force mains shall be adequately sized to handle the design peak flow of the drainage basin. At design pumping rates, a cleansing velocity of at least two feet per second shall be maintained. Velocity shall not exceed six feet per second.
- g. An automatic air relief valve for sewage application shall be placed at high points in the force main to prevent air locking and other points dictated by the design.
- h. The force main should enter the gravity sewer system at a point not more than two feet above the invert of the receiving manhole.

8.0.3 Additions to Gravity Sanitary Sewer Specifications:

- a. Sewer lines in relation to water lines must conform to 'Ten States Standards', Section 38.3, at a minimum.
- b. Infiltration/exfiltration cannot exceed 200 gallons/ day/inch of pipe diameter/mile of pipe.
- c. Each section of pipe should be laid to the specified line and grade, working in the upstream direction with the bell end laid upgrade.
- d. PVC pipe must conform to ASTM D-3033, D-3034 or F-789-82, latest revision.
- e. PVC pipe must be installed in accordance with ASTM D-2321, latest revision.
- f. Ductile iron pipe must conform to ASTM A-746, ANSI A21.50, ANSI A21.51, AWWA C150 or AWWA C151, latest revision.
- g. Precast concrete manholes must conform to ASTM C-478, latest revision.
- h. The top elevation of all manholes must be above the 50 year flood plain, or have watertight manhole covers.

8.0.4 Additions to Force Main Specifications:

- a. Sewer force mains in relation to water lines must conform to 'Ten States Standards', Section 38.3, at a minimum.
- b. PVC force main must conform to ASTM D-2241, latest revision.

- c. PVC force main must be installed in accordance with ASTM D-2321, latest revision.
- d. Ductile iron force main must conform to ASTM A-377, latest revision.