CITY OF FORT SMITH
MINIMUM SANITARY SEWER STANDARDS REVISIONS

1. SCOPE

No sanitary sewer facility shall be constructed, altered, extended, or reconstructed within a subdivision, planned development, or a developed area within the planning jurisdiction of the City of Fort Smith, Department of Public Works, and appropriate State and Federal regulatory agencies, and all such construction shall meet the requirements of the following "General Requirements and Design Criteria."

2. GENERAL REQUIREMENTS AND DESIGN CRITERIA

2.1 Design Period

In general, sewer systems shall be designed for the estimated ultimate tributary population. Similarly, consideration should be given to the maximum anticipated capacity of institutions, industrial parts, etc.

2.2 Design Factors

In determining the required capacities of sanitary sewers, the following factors should be considered:

1. Maximum hourly sewage flow.
2. Additional maximum sewage or waste flow from industrial plants.
3. Ground water infiltration.
4. Topography of area.
5. Location of waste treatment plant.
6. Dept of excavation.
7. Pumping requirements.

2.3 Design Basis

2.3.1 Calculations

Computations should be presented, in a tabular form, to indicate depths and velocities at maximum daily water flows for the different sizes of sewers proposed.

2.3.2 Residential Design Flows

New residential sewer systems shall be designed on the basis of an average daily per capita flow of 100 gallons per capita per day. This figure is assumed to cover normal infiltration. Single family homes shall be assumed as an average of 3.5 people per household.
Apartments shall be assumed to have an average of 4 people per 3 bedroom unit; 2.2 people per two bedroom unit and 1.7 people per one bedroom unit.

2.3.3 Commercial and Industrial Design Flows

Commercial and industrial areas shall be designed using a minimum peak flow of 6000 gal./acre/day. Wherever heavier usages are anticipated, design shall be based on anticipated peak flows.

2.3.4 Design Flows

Generally sewers shall be designed to have a capacity not less than 2/3 of the design capacity flowing full to allow for sulfide gas dissipation at peak loading. Laterals and sub mains shall be designed with a peak versus average daily flow factor of 4. Mains, trunks, interceptors and outfall sewers (sewers that serve an excess of 400 units and have a length in excess of 2000 feet) shall be designed with a peak to average daily factor of 2.5.

2.4 Sewer Lines - General Requirements and Design Criteria

2.4.1 Minimum Size

No sewer shall be less than 8 inches in diameter, except for isolated areas where no expansion is possible. In these areas 6" lines may be used with design flow less than 50% of capacity.

2.4.2 Depth

In general sewers shall be sufficiently deep so as to receive sewage from basements wherever practical. The minimum cover over any sewer line shall be 24".

2.4.3 Slope

All sewers shall be so designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second, based on Kutter’s formula using an "N" value of 0.013. Use of other practical "N" valves may be permitted by the plan reviewing agencies if deemed justifiable on the basis of research or field data presented. The following are the minimum slopes which should be provided; slopes greater than these are desirable:
<table>
<thead>
<tr>
<th>Sewer Size</th>
<th>Minimum Slope in Feet Per 100 Feet</th>
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<tbody>
<tr>
<td>6 inch</td>
<td>0.60</td>
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<tr>
<td>30 inch</td>
<td>0.058</td>
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<tr>
<td>36 inch</td>
<td>0.046</td>
</tr>
</tbody>
</table>

Sewers on 20% slope or greater shall be anchored securely with concrete anchors or equal, spaced as follows:

a. Not over 36 feet center to center on grades 20% and up to 35%.

b. Not over 24 feet center to center on grades 35% and up to 50%.

c. Not over 16 feet center to center on grades 50% and over.

2.4.4 Alignments

Sewers shall be laid with straight alignment between manholes.

2.4.5 Increasing 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.

2.4.6 High Velocity Protection

Where velocities greater than 15 feet per second are attained, special provision shall be made to protect against displacement by erosion and shock.
2.4.7 Materials

Any generally accepted material for sewers approved by the Arkansas State Board of Health will be given consideration, but the material selected should be adapted to local conditions, such as character of industrial wastes, possibility of septicity, soil characteristics, exceptionally heavy external loadings, abrasion and similar problems. All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be made because of the width and depth of trench. When standard strength sewer pipe is not sufficient, the additional strength needed may be obtained by using extra strength pipe or by special construction.

2.5 Manholes - General Requirements and Design Criteria

2.5.1 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 sewer 15 inches or less, and 500 feet for sewers 18 inches to 30 inches. Greater spacing may be permitted in larger sewers as approved on specific projects. Cleanouts may be used only for temporary dead end lines and shall not be substituted for manholes nor installed at the end of laterals greater than 150 feet in length.

2.5.2 Drop Manholes

A drop pipe should 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 should be fellated to prevent solids deposition.

2.5.3 Diameter

The minimum diameter of manholes shall be either 48 inches or 1 1/2 times pipe diameter, whichever is larger.

2.5.4 Flow Channel

The flow through manholes shall be generally made to conform to the size and shape of the sewers that come into the manholes. Changes in grade or alignment shall
be made smoothly with as large a transition as possible. Additional drop through manholes shall be added where the head lost through manholes is excessive such as at bends or changes in pipe grades.

2.5.5 Watertightness

In all areas where manhole covers are subject to inundation and high water or runoff from storms, the manholes shall have watertight or sealed manhole covers installed or be raised to an elevation above the 100 year flood elevation. Manholes of brick or cement block shall be waterproof on the interior and exterior with 1/2" minimum plaster coatings. In areas where water tightness problems still occur, a supplemental bituminous coating on the exterior of the manhole may be required. In lawns and open fields, manhole covers shall generally replace 0.2 to 0.3 above the original natural ground and the earth sloped around the manhole to prevent the entrance of surface water into the manholes. No manhole lids with holes in the covers will be allowed.

2.6 Sewer Extensions

In general, sewer extensions shall be allowed only if the receiving lines are capable of handling the added flows.

2.7 Protection of Water Supplies

2.7.1 Water Supply Interconnections

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 sewer or polluted water into the potable supply.

2.7.2 Relation to Water Works Structures

While no general statement can be made to cover all conditions, it is generally recognized that sewers shall meet the requirements of the approving agencies with respect to minimum distances from public water supply wells or other water supply sources and structures.
2.7.3 Relation to Water Mains

2.7.3.1 Horizontal Separation

Sewers shall be laid at least 10 feet, horizontally, from any existing or proposed water main.

2.7.3.2 Vertical Separation

Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the weatherman. When the elevation of the sewer cannot be buried to meet the above requirements, the water main shall be relocated to provide this separation or both sewer and water line shall be constructed of a material approved for both water mains and sanitary sewers for a minimum distance of 10 feet on each side of the crossing. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.

2.8 Service Lines

2.8.1 Where a sanitary sewer is to be installed in a developed area, a wye, cap and riser where the sewer is in excess of 7' deep shall be installed for all properties along the line that currently have development on the properties. If the streets are to be constructed as a part of the sanitary sewer construction project, service lines shall be installed additionally from the main to the property line of all properties to be served by this sewer. In new developments sanitary sewer service shall be installed for all lots. This shall include a wye and a riser, if the sewer is at a depth greater than 7', a service line with a minimum size of 4" and a cap.

2.8.2 Where the sanitary sewer crosses the property only a wye and riser will be required. Where the sanitary sewer is in the right of way immediately adjacent to the property, a service line shall be installed from the main to the property to be served.
2.9 Easements

2.9.1 All sanitary sewers not constructed in public right of way shall be constructed in a utility easement dedicated to public use. The minimum width of sewer easement shall be 15 feet or 2 1/2 times the depth of the line, whichever is greater.

2.10 Design Data, Maps, Computations, Plans and Specifications

2.10.1 All designs, plan and specifications submitted to the City for approval for the construction of sewerage works as required herein shall be prepared by a registered professional engineer, licensed in the State of Arkansas, and shall meet the minimum standards specified herein.

2.10.2 Plan Requirements

Plan sizes shall be uniform for each set. Where practical, plans shall be submitted on approximately 24" x 36" sheets. The plans shall include:

2.10.2.1 Locations of the project with respect to well known roads, streets, subdivisions or survey lines on a key map of the entire project to scale, showing easements, sewer lines and facilities, both existing and to-be-constructed.

2.10.2.2 Plans for each sewer line, showing locations, size, design, flow, flowline elevations, gradients, materials, boring information and rock elevations were known along the proposed sewer line where applicable, locations, depths and sizes of adjacent or crossing utilities; and special constructions requirements such as concrete cradle, easement, backfill, size, and class of pipe, etc.

2.10.2.3 All elevations shall be based upon USGS datum with location of bench mark given.

2.10.2.4 Details of special structures, manholes, service wyes and rises, trestle, water line crossings, and bedding all adequately detailed and dimensioned.
2.10.3 Sewer Service Area Map

An area map showing topography shall be furnished with sewer service area outlined.

3. SEWAGE PUMPING STATIONS - GENERAL REQUIREMENTS AND DESIGN CRITERIA

3.1 General

3.1.1 Flooding

Sewage pumping stations shall not be subject to flooding, within a 100 year return period. A suitable superstructure preferably located off the right-of-way of streets and alleys should be provided. The station shall be readily accessible by an all weather access road in an easement dedicated to public use.

3.1.2 Grit

Where it may be necessary to pump sewage prior to grit removal the design of the wet well should receive special attention and the discharge piping shall be designed to prevent grit settling in pump discharge lines of pumps not operating.

3.2 Design

The following items shall be given consideration in the design of sewage pumping stations:

3.2.1 Type

Sewage pumping stations shall be of the dry well type except as noted in section 3.2.3.

3.2.2 Structures

3.2.2.1 Separation

Wet and dry wells including their superstructure shall be completely separated.

3.2.2.2 Pump Removal

Provisions shall be made to facilitate removing pumps and motors.
3.2.3 Access

Suitable and safe means of access shall be provided to dry wells of pump stations and shall be provided to wet wells containing either bar screens or mechanical equipment requiring inspection or maintenance. Stairways should be installed, with landings provided at all areas where maintenance is required.

3.2.3 Suction Life Sewer Pump Stations

3.2.3.1 General

In locations where peak flows are less than 200 gallons per minute and where a suction lift of less than 15 feet is required, suction lift pump stations will be permitted, meeting the following requirements.

3.2.3.2 Construction

3.2.3.2.1 The super-structure for the suction lift pump stations shall be of a permanent masonry construction that is lockable and has architecture compatible with the surrounding development. An adequate thermostatically controlled heating system, adequate lighting and automatic ventilation system shall be included in the station. The superstructure shall be constructed in such a way that the structural strength in members in the superstructure will work as hoisting beams for the removal of pumps and other equipment within the station. All piping within the station shall be stainless steel, cast iron or other approved materials.

3.2.3.2.2 All applications for use of a suction lift pump station shall contain a series of records showing that the proposed equipment to be used has a reliable record of satisfactory operation at other installations.

3.2.3.3 Access
The wet well and super-structure shall have separate access openings and the wet well shall be accessible from outside the super-structure with adequate separation between structures to allow for separate ventilation.

3.3 **Pumps and Pneumatic Ejectors**

3.3.1 **Duplicate Units**

At least 2 pumps or pneumatic ejectors shall be provided. If only 2 units are provided, they should have the same capacity. Each shall be capable for handling flows in excess of the expected maximum flow. Where 3 or more units are provided, they should be designed to fit actual flow conditions and must be of such capacity that with one unit out of service the remaining units will have capacity to handle maximum sewage flows.

3.3.2 **Protection Against Clogging**

Pumps handling raw sewage flows in excess of 1,000 g.p.m. shall be preceded by readily accessible bar screens with clear openings not exceeding 2 1/2 inches. Where the size of the installation warrants, a mechanically cleaned bar screen with grinder, or comminution device is recommended. Where screens are located below ground, convenient facilities must be provided for handling screenings. For the larger or deeper stations, duplicate protection units of proper capacity are preferred.

3.3.3 **Pump Openings**

Pumps shall be capable of passing spheres of at least 3 inches in diameter. Pump suction and discharge openings shall be at least 4 inches in diameter.

3.3.4 **Priming**

The pump shall be so placed that under normal operating conditions it will operate under a positive suction head.
3.3.5 Electrical Equipment

Electrical equipment in enclosed places where gas may accumulate shall comply with the National Board of Fire Underwriters specifications for hazardous conditions (NEMA Type 7).

3.3.6 Intake

Each pump should have an individual intake. Wet well design should be such as to avoid turbulence near the intake.

3.3.7 Dry Well Dewatering

A separate sump pump shall be provided in the dry wells to remove leakage or drainage with the discharge above the overflow level of the wet well. All floor and walkway surfaces should have an adequate slope to a point of drainage. In larger stations duplicate sump pump units shall be furnished.

3.4 Controls and Alarm Systems

3.4.1 Controls

Level controls shall be of the bubbler type with duplicate compressors.

3.4.2 Alarm Systems

Alarm systems should be provided for all pumping stations. The alarm shall be activated in cases of power failure, pump failure, or any cause of pump stations malfunction. Alarm systems shall be compatible with and shall inter-connect with existing monitoring system of Fort Smith water and sewer operations department.

3.5 Valves

Suitable shutoff valves shall be placed on suction and discharge lines of each pump. A check valve shall be placed on each discharge line, between the shutoff valve and the pump.
3.6 Wet Wells

3.6.1 Size

The effective capacity of the wet wells shall provide a holding period not to exceed 10 minutes for the design average flow. The minimum diameter of the wet well shall be 4 foot round or 4 square.

3.6.2 Floor Slope

The wet well floor shall have a minimum slope of 1 to 1 to the hopper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and function of the inlet.

3.7 Ventilation

Adequate ventilation shall be provided for all pump stations. Where the pump pit is below the ground surface, mechanical ventilation is require, so arranged as to independently ventilate the dry well and the wet well if screens or mechanical equipment requiring maintenance or inspection are located in the wet well. There shall be no interconnection between the wet well and the dry well ventilation systems. In walls over 15 feet deep, multiple inlet and outlets are desirable. Dampers should not be used on exhaust or fresh air ducts and fine screen or other obstructions in air ducts should be avoided to prevent clogging. Switches for operation of ventilation equipment should be marked and located conveniently. All intermittently operated ventilating equipment shall be inter-connected with the respective pit lighting system. Consideration should be given also to automatic controls where intermittent operation is used. The fan wheel should be fabricated from non-sparking material. Automatic heating and dehumidification equipment shall be required in all pumping stations.

3.7.1 Dry Wells

Ventilation may be either continuous or intermittent. Ventilation, if continuous, should provide at least 6 complete air changes per hour; if intermittent, at least 30 complete air changes per hour. Such ventilation shall be accomplished by introduction of fresh air into the dry well by mechanical means.

3.8 Flow Measurement

Suitable recording devices for measuring sewage flow shall
be provided at all pumping stations. On stations with average daily flows less than 500 gallons per minute this may be accomplished by calibrating the flow in the foremain and installing recording hours meters on each individual pump.

3.9 Water Supply

There shall be no physical connection between any potable water supply and a sewage pumping station which under any conditions might cause contamination of the potable water supply.

3.10 Emergency Operation

3.10.1 Objective

The objective of emergency operation is to prevent the discharge of raw or partially treated sewage to any waters and to protect public health by preventing backup of sewage and subsequent discharge to basements, street, and other public and private property.

3.10.2 Emergency Power Supply

Provision of an emergency power supply for pumping stations serving 50 or more homes should be made, and may be accomplished by connection of the station to at least 2 independent public utility sources, or by provision of portable or in-place internal combustion engine equipment which will generate electrical or mechanical energy, or by the provision of portable pumping equipment.

3.10.2.1 In-Place Emergency Equipment

Where in-place internal combustion equipment is utilized, the following guidelines are suggested for use:

3.10.2.1.1 Placement

The unit shall be bolted in place. Facilities shall be provided for unit removal for purposes of major repair or routine maintenance.

3.10.2.1.2 Controls

Provisions shall be made for automatic and manual start-up and cut-in.
3.10.2.1.3 Size

Unit size shall be adequate to provide power for lightning and ventilation systems and other systems affecting capability and safety.

3.10.2.1.4 Engine Location

The unit internal combustion engine shall be located above grade with suitable and adequate ventilation of exhaust gases.

3.10.2.2 Portable Emergency Equipment

Where portable equipment is utilized the following guidelines are suggested for use: Pumping units shall have capability to operate between the wet well and the discharge side of the station, with the station provided with permanent fixtures which will facilitate rapid and easy connection of lines. Electrical energy generating units shall be protected against burn-out when normal utility services are restored, and shall have sufficient capacity to provide power for lighting and ventilation systems and such further station systems affecting capability and safety.

3.10.2.3 Emergency Power Generation

All emergency power generation equipment should be provided with instructions and indicating the essentiality of routinely and regularly starting and running such units at full load.

3.10.3 Overflows

The provision of a high-level wet well overflow to supplement alarm systems and emergency power generation should be considered. Where a high level overflow is utilized, consideration shall also be given to the installation of storage detention tanks, or basins, which shall be made to drain to the station wet well. Where such overflows affect public water supplies, shell-fish production, or waters used for culinary or food processing purposes, a storage-detention basin, or tank, shall be provided having 2 hour detention capacity at the anticipated overflow rate.

3.11 Instructions and Equipment

Sewage pumping stations and their operators should be
supplied with a complete set of operational instructions, including emergency procedures, maintenance schedule, tools and such spare parts as may be necessary. All components shall be produced by a reputable manufacturer and shall have spare parts available on demand.

3.12 Force Mains – General Requirements and Design Criteria

3.12.1 Velocity

At design average flow, a cleansing velocity of at least 2 feet per second shall be maintained.

3.12.2 Air Relief Valve

An air relief valve shall be placed at high points in the force main to prevent air locking.

3.12.3 Termination

Force mains should enter the gravity sewer system at a point not more than 2 feet above the flow line of the receiving manhole unless a drop manhole is constructed.

3.12.4 Line Size

Minimum line sizes for force mains shall be 4 inches and the design shall comply with the General Design Requirements as far as velocities, depth of bury, and similar items as defined in the Criteria for Water Distribution Lines of the City of Fort Smith.

3.13 Sewer Checklist

The following items shall be included with the submittal of all sewer plans:

1. A plan and profile on scale of not less than 1" = 100’ for all lines.

2. Project specifications for the job.

3. Copies of letters of submittal to state and federal agencies requiring approval.

4. Copy of proposal sheet.

5. Detail sheet.

6. Locations of wyes and services for all lots to be served.
7. Design calculations including:
   a. Map of area to be served.
   b. Proposed population of area to be served bases on zoning.
   c. Capacity calculations at changes in pipe size and critical points including justification as necessary the downstream lines will not be overloaded by the proposed improvement.

8. Proper distances between manholes.

9. Proper grades.

10. Adequate right-of-way or easements.

11. Separation from water lines.

12. Location of areas subject to flooding and method for protecting manhole.

13. Proposed street grades for streets on the profile.

14. Street surfaces to be crossed, type and length and existing obstructions along line and surface features.