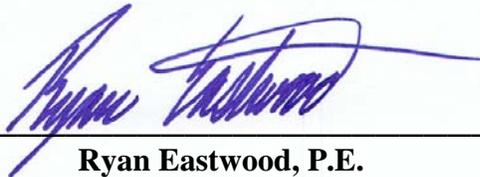


Sanitary Sewer Design, Construction & Maintenance Manual

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City of Ashland, Kentucky

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1 Purpose

The purpose of this document is to outline the requirements for proper sanitary sewer pipe sizing, construction and inspection. Compliance with this design guidance is required, unless otherwise approved by the city engineer. Design and installation criteria not specifically addressed in this document shall conform to the Recommended Standards for Wastewater Facilities - 1990 - or latest edition (Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, commonly referred to as 10 State Standards).

2 Horizontal Alignment and Location

All sewers shall be constructed with a straight alignment between manholes. The maximum distance between manholes shall be 300 feet. Sewer lines shall be placed no less than 10 feet horizontally to permanent structures (ie. houses, buildings, retaining walls...etc.) The city engineer may require that additional clearance be provided based on the depth and size of the sewer. Sewer shall not be placed within creeks, streams, ditches, ponds, detention facilities, or structural embankments. Sewer lines shall be placed outside of the pavement where possible.

3 Vertical Alignment and Location

All sewers shall be constructed with a constant straight grade between manholes. Sewers shall have a minimum cover of three (3) feet. Sewer pipes should be designed to enter the manhole at the bottom of the manhole where feasible. Sewers placed at depths of 25 feet or greater shall be ductile iron. Sewers placed on a gradient at or above 20% shall be anchored with concrete anchors at a minimum of every 36 feet.

4 Water Main Separation

Sewer lines shall be placed no less than 10 feet horizontally to waterlines or one and a half (1.5) feet vertically. The sewer should be located below water mains at crossings when possible.

5 Manholes

All manholes on a proposed sewer line shall be precast concrete and of the appropriate size for the designed pipe sizes. The minimum manhole diameter shall be 4 feet.

Manholes shall be located at all changes in pipe grade, pipe size, pipe material, pipe alignment, pipe intersections and at the end of a run of pipe. Manholes that are placed in pavement shall be placed to avoid the traffic's wheel path as much as practical. Manholes shall be placed in areas easily accessible by the city.

Manhole bottoms shall be formed to provide benches. Benches in the bottoms of manholes shall extend above ½ of the inflow pipe diameter at a minimum. The bench shall slope upward from the flow channel to the walls of the manhole.

An outside drop structure shall be installed if the elevation difference between the inflow pipe invert and the bottom of the manhole is two (2) feet or greater. Inside drops may be permitted, with permission by the city engineer, for connections to existing manholes. Only one inside drop per manhole shall be permitted. Inside drops shall not interfere with existing manhole steps.

Manhole lids shall be constructed at least one (1) foot above the 100 year floodplain elevation.

Manhole lids shall be watertight including the lifting holes. The manhole lid shall have the words "sanitary sewer" cast into it. All manhole lids placed in pavement or traffic areas shall be heavy duty.

6 Pipe Size

The minimum pipe diameter, other than individual property service connections, shall be eight (8) inch. The minimum property service connection shall be four (4) inch for services less than or equal to 20 feet in length; and six (6) inch for services greater than 20 feet in length. No more than one building or residence, with exception to accessory structures, shall be served by less than an eight (8) inch line unless otherwise approved by the city engineer.

7 Materials

All proposed pipe materials shall be as per local industry standards and shall be approved by the city engineer. All materials and specifications shall be indicated on the plans.

All gravity sewers must have granular bedding to a minimum depth of 4 inches under the pipe with the bedding material extending up to a minimum of the centerline of pipe.

8 Service Laterals

Service laterals or private service lines shall be tied into the public mainline sewer with wye connections or other methods approved by the Director of Utilities. Under no circumstance shall a service line connection protrude into the diameter of the mainline pipe causing an obstruction.

Service lines may also be directly connected into manholes. Any service line connected to a manhole above 2.0' from the bottom of the manhole shall have an inside or outside drop installed.

No new private service laterals shall be permitted to run through private property or across another property's frontage to serve a different property, even if both properties are owned by the same owner. Property owners requesting sewer service must have a public mainline located on their property or within the road right-of-way (on either side of the road) within the limits of the property frontage; otherwise a public main extension is required at the owner's cost.

Property owners are responsible for cleaning and unclogging of service laterals to the point of connection with the public sewer main, even if the existing lateral is on another property owner's land or within the public right-of-way. If a service lateral located within an improved public right-of-way fails requiring replacement or repair by excavation which would impact existing city infrastructure (i.e. roads, sidewalks, storm sewers); the City of Ashland will repair the line at the City's expense.

9 Service Pipe Risers

Risers shall be permitted where the depth of the mainline is over two (2) feet below the proposed service pipe connection elevation. The minimum riser length is two (2) feet. All risers shall be laid at 45° from vertical where possible. No riser shall be installed steeper than 15° from vertical. Risers installed between 15° and 45° from vertical shall be concrete encased at the wye.

10 Design Flows

Average daily design flows are as follows:

Development	Population per Unit	Average Daily Flow
Single Family Dwelling	4 people	400 gpd
1 bedroom apartment	2 people	200 gpd

2 bedroom apartment	3 people	300 gpd
3+ bedroom apartment	4 people	400 gpd
Hotel/Motel Rooms	1.5 people	200 gpd

For other development types, the developer / developer’s engineer shall submit proposed flow estimations for review.

11 Hydraulic Design Requirements

A.) Manning’s Equations

Use Manning’s Equation to determine the proper size and slope to transport the design flow. All hydraulic calculations shall be based on a pipe roughness coefficient of 0.013 (Manning’s N) regardless of pipe material. All sewer calculations shall include

B.) Pipe Grade

Sewers shall be designed to provide a minimum flow velocity of 2 fps flowing full.

The table below outlines the minimum allowable slopes:

Pipe Diameter	Slope
8 inch	0.40%
10 inch	0.28%
12 inch	0.22%
15 inch	0.15%
18 inch	0.12%

Flow volumes in excess of 15 fps should be avoided where possible. End of sewer runs should be increased, where possible, to provide adequate cleansing velocity. If the proposed design flow does not exceed 15% of the pipe capacity, the pipe slopes shall be steepened to provide adequate cleansing velocity.

Private service laterals shall have a minimum slope of 1/8 inch per foot; however a slope of 1/4 inch per foot is preferred.

C.) Design Peak

A peak factor of 3.5 multiplied by the average daily flow shall be used to determine the peak sanitary sewer flow.

D.) Pipe Capacity

Design flows shall not exceed 100% of design capacity of the proposed sewer lines.

12 Easements

Easements shall be dedicated to the City of Ashland for the installation of sewer lines. Easements must be in the form of an exclusive sanitary sewer easement or a general utility easement. The minimum width of easement for sewer mains is 15 feet, and may be increased at the discretion of the city engineer based on sewer depth and other factors. Sewers shall be located in the center of the sewer easement where possible. The sewer shall not be placed closer than 5 feet to the edge of the easement.

No permanent structures shall be permitted in, on, over, or under the land within the easement. Developers and their Engineer shall plan the utilities, easements, property lines and other features of the development so homeowner improvements such as decks, patios, outbuildings, porches, retaining walls, etc. will not encroach on the easement. No utilities shall be placed within 5 feet of the sewer without approval of the city engineer.

13 Construction Plan Requirements

All sanitary sewer plans submitted to the City of Ashland for approval shall be prepared, signed and sealed by a Professional Engineer licensed in the State of Kentucky.

All plans shall be prepared on 22" x 34" or 24" x 36" plan sheets, unless otherwise approved by the city engineer. The engineer shall submit four (4) sets of plans for review. The city will notify the engineer when the plan comments are available for pick-up. After the city's comments are adequately addressed, the engineer shall submit two sets of signed and sealed plans for signature by the city engineer. One set will be provided to the engineer and the city retains the other original. Additional copies of the plans shall be provided at the developer's expense at the request of the city. The engineer shall also submit a pdf file of the final approved plan to the city engineer.

The following items must be shown on construction plans for proposed sewers.

- North Arrow
- Stationing for each run beginning at 0+00 and proceeding from the lowest end to the highest.

- Signature block for the city engineer as follows:

The City of Ashland signatures on this plan signify only concurrence with the general purpose and location of the proposed improvement. All technical details remain the responsibility of the professional engineer who prepared and certified these plans.

City Engineer

Date

- Clear indication of which improvements are public versus private
- Estimate of quantities
- General notes
- Scale (must be engineering scale). Preferred scale is 1" = 50' horizontal and 1" = 10' vertical.
- Rights-of-way, Property lines and Owners
- Utilities – All existing and proposed utilities shall be shown and clearly labeled.
- Service lines – Show all existing and proposed service lines including sizes, material, depth and location.
- Risers – Length and angle of risers shall be indicated.
- Benchmarks - All elevations shall be based on a published USGS datum. The datum shall be indicated on the plans including the source benchmark location, elevation and description. There must be a minimum of two on-site benchmarks. The plans shall indicate the benchmark location, elevation and description.
- Elevations –All sewer plans shall indicate the elevations of the following items:
 - Service connections
 - Mainline pipe inverts at manholes
 - Top of manhole castings
 - End of service
- Bedding, Backfill, Casing Pipe and Encasement – All bedding, backfill, encasement and casing pipe must be clearly indicated by notes or by limits on the plan. Material, details, depths and specifications must be indicated on the plans.
- Existing and Proposed Ground Elevation – Must be shown by profile or by contours and/or spot grades.

14 Testing

The testing of sewage force mains and gravity sewers shall be accomplished in accordance with the procedure listed hereinafter.

A.) Force Mains

Force mains shall be tested by performing a hydrostatic test. The force main shall be completely filled with water and subjected to an internal pressure of 100 psi or 2.5 times the operating pressure, whichever is greater, not to exceed 125 percent of the maximum pressure rating for the pipe, measured at the downstream end. The pressure shall be held for a period of two (2) hours. During the test, leakage from the force main shall be measured. The maximum allowable leakage shall be ½ gallon per inch diameter per 1,000 feet of pipe per hour. Where practicable, pipelines shall be tested between valves or plugs in lengths of not more than 1500 feet. Pipelines shall be tested before backfilling at joints except where otherwise required by necessity, local ordinance, or public convenience. Duration of test shall be not less than two hours where joints are exposed and not less than 24 hours where joints are covered. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the joints shall be re-caulked, re-poured, bolts re-tightened or re-laid, and leakage minimized, regardless of total leakage as shown by test. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the Contractor's expense. Lines that fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Where nonmetallic joint compounds are used, pipelines should be held under normal operating pressure for at least three (3) days before testing.

B.) Gravity Sewer Lines

Prior to final inspection, the Contractor shall clean out the entire system by pushing through each individual line in the system, from manhole to manhole, appropriate tools for the removal of any and all dirt, debris and trash from the lines. Debris and trash must be removed from the lines, not flushed into the public system.

During or subsequent to the final inspection, the Engineer will inspect each individual line, from manhole to manhole, either by use of televisions, lights or other means at his disposal to determine whether the completed lines are true to line and grade as shown on the plans. All lines or sections of lines that are found to be laid improperly, contain broken or leaking sections of pipe, not properly jointed, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced at the Contractor's expense.

The Contractor shall lay sewer lines so as to generally be water tight, including house connections. Any locations of visible leakage shall be replaced or repaired as otherwise approved by the Engineer.

If during the final inspection, it is determined that the pipe integrity appears to have been compromised, deflection tests may be required on flexible pipe at the discretion of the city engineer. The test shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system. All jetting activity shall be completed prior to deflection testing. No pipe shall exceed a deflection of five (5) percent. A properly sized, manufactured mandrel shall be used for deflection test. It shall have a diameter not less than 90% of the nominal inside diameter of the pipe, depending on which is specified in the ASTM Specifications. The pipe shall measure in compliance with ASTM D 2122. The test shall be performed without any mechanical pulling devices.

The city may require infiltration testing, exfiltration testing or low pressure air testing depending on the ground water conditions. In no case shall the rate of leakage, exfiltration or infiltration, average more than 200 gallons per inch pipe diameter per 24 hours per mile of sewer.

Manholes shall be tested by plugging connecting pipes and filling the manhole with water to 2 feet above the crown of the highest entering pipe. After the manhole has been allowed to stand for 24 hours, no loss of water will be permitted in a 4 hour period.

Vacuum testing of manholes may be required by the Engineer, when concerns exist about possible infiltration due to high groundwater and/or deep manholes, manhole construction or manhole installation. Vacuum testing shall be done in accordance with ASTM C1244-93 (current edition). Where practical, testing shall be performed prior to backfilling around the structure. If testing is performed following backfilling, proper determination of groundwater elevation shall be completed and appropriate adjustment made for vacuum testing pressure.

15 Prior to Construction

The following must be provided / completed prior to construction:

1. Proposed easements must be reviewed and approved by the city.
2. A preconstruction meeting must be scheduled with the city engineer at least 48 hours prior to construction.
3. Contractor must install a mechanical plug at the connection point to the public sewer prior to construction. Plug location shall be coordinated with the city engineer. The plug shall not be removed prior to acceptance of the sewer's by the city.
4. The construction plans must be approved by the city.
5. A construction bond must be provided to the city for 100% of the estimated cost of construction. Construction cost shall be estimated by

the developer's engineer and approved by the city prior to posting the bond. The city will accept a bond or irrevocable letter of credit.

6. Estimated construction schedule
7. Contractor must make a request for inspection 48 hrs prior. No inspection shall be performed on holidays or weekends.

16 Prior to Acceptance by City of Ashland

The following must be provided / completed prior to acceptance by the city or release of the construction bond:

1. Recorded Easements
2. As-Built record plans (2 sets and one pdf file)
3. Approved Division of Water permit to install
4. All testing performed and passed
5. Final Inspection - Any punch list items must be remedied prior to acceptance.
6. Affidavit of payment / Waiver of lien rights by contractor and subcontractors.