DURHAM COUNTY UTILITIES

Design Standards

Summary of Revisions
Adopted April 29, 2020

Section 01: Sanitary Sewer

All public and private sanitary sewer collection mains inside the Durham County Utilities service area that will connect or are planning to discharge into the Durham County sewer system shall comply with all Durham County design, siting, and installation criteria outlined herein. The Owner of the private sewer collection system shall meet all design requirements and obtain a State permit to operate the private system.

I. Sanitary Sewer Mains

A. General

1. A sanitary sewer main is a collection system of 2 or more laterals. A sanitary sewer permit is required for all sanitary sewer mains, and as defined by Title 15A of the North Carolina Administrative Code, Subchapter 2H.

B. Design Flow

1. Sanitary sewer pipe capacity shall be designed for the ultimate tributary population with special consideration given to maximum anticipated institutional capacity. Downstream capacity to accept future flow made tributary to the sanitary sewer collection system shall be evaluated by the Engineer.
2. Calculations shall be based on Manning's formula using a "n" value of 0.013 to achieve a minimum velocity of 2.5 feet per second (ft/sec) through the pipe when flowing half full at the average daily flow. The minimum slope of any sanitary sewer main will also govern the capacity of this pipe.
3. Sanitary extensions shall be designed for projected flows, even when the diameter of the receiving sewer is less than the diameter of the proposed extension.
4. Sanitary sewer flow rates shall be in accordance with 15A NCAC 02T .0114 Wastewater Design Flow Rates or engineering best practices if not included.

C. Pipe Diameter

1. Standard pipe diameter for public sewer mains are 8-inch, 12-inch, 15-inch, 18-inch, 24-inch, 30-inch, 36-inch and 48-inch. 10-inch and 21-inch diameter pipe are not permitted.
2. A private sanitary sewer main shall be no less than 6-inches in diameter.
3. Building laterals that are 8-inch or larger are considered a sanitary sewer main once they leave the building.

D. Slope Requirements

1. Minimum slope requirements are:
    i. 6-inch diameter pipe – 1.00% minimum slope (private line size)
    ii. 8-inch diameter pipe – 0.60% minimum slope
    iii. 12-inch diameter pipe – 0.50% minimum slope
    iv. 15-inch diameter pipe or greater – 0.25% minimum slope
2. Maximum allowable slope on sanitary sewer mains is 10%.
3. On pipe located at the highest point of the sanitary sewer system, the first 500-linear feet (LF) of pipe shall have a 2.0% minimum slope or steeper to achieve the minimum flushing velocity. Calculations may be required.

E. Material

1. Standard sanitary sewer line material is to be PVC or ductile iron pipe (DIP). Durham County may require DIP in certain conditions.

Depth	Material
< 3-feet	DIP
3-feet to 12-feet	SDR 35 or DIP
12-feet to 16-feet	SDR 26 or DIP
> 16-feet	DIP

2. All DIP shall be pressure class 350 and lined with Protecto 401 or an approved equal. Liners shall be applied per manufacturer's requirements at the factory and must meet all ASTM requirements. Field application/patching of Protecto 401 coating after installation shall not be approved.
3. All pipe supplied with Protecto 401 interior lining shall be installed within one year of the application date on the pipe and shall be free of defects. Pipe installed with defects in the lining will be rejected and required to be replaced.
4. All sanitary sewer mains located in casing pipes shall be restrained joint DIP.
5. Transition of materials shall be done at manholes. Material transition between manholes is not allowed.

F. Location

1. In preparing engineering design plans for sanitary sewer mains, all elevations shall be tied to North Carolina State Plane (NAD83), U.S. Survey Feet and North American Vertical Datum, 1988 (NAVD 1988).
2. Sanitary sewer lines (excluding outfalls) shall be located:
    i. Under pavement within the right-of-way.
    ii. On the south and west sides of streets.
    iii. In the center of the driving lane of the street.
    iv. Along natural drainage courses to all adjacent upstream property lines.
    v. In a right-of-way (ROW) or permanent dedicated sanitary sewer easement to allow County personnel access to the main for maintenance and repair.

G. Depth

1. The depth of sewer mains shall be great enough to serve adjoining property, for extension further up tributary to support future development, sufficient to meet both Durham County's minimum depth standard and allow for sufficient grade/clearances on the service line.
2. Sanitary sewer mains shall be designed meeting minimum depth requirements for both sanitary sewer outfalls and street mains. If minimum depth cannot be met, DIP is required.
    i. Sanitary sewer outfalls shall maintain a minimum depth of 4-feet from the ground elevation to the pipe crown.
    ii. Sanitary sewer mains in the street require a minimum depth of 5-feet from the ground elevation to the pipe crown.
3. The maximum depth of sewer along or in roadways is 18-feet deep.

4. The County may require parallel and/or oversized sewer lines with wider easements for sanitary sewer mains greater than 16-feet in depth.
5. Top of encasement pipes are to be kept 3-feet below streambed flow line elevations to avoid aerial stream crossings. The pipe shall be placed to center the crossing at the midpoint between joints of the pipe (keeping the joints as far from the creek as possible).

II. Sewer Taps and Laterals

A. General

1. Sanitary sewer services shall be installed according to the Durham County standards and specifications.
2. Sanitary sewer connections to stubbed out services shall not be made until construction drawings are approved.
3. Sewer service inverts shall be shown on the plan & profiles when connecting into a manhole.
4. Sewer services greater than 100-feet in length shall be profiled on construction drawings with all crossings shown (excluding single family houses).
5. Terminal manholes in cul-de-sacs are allowed to have 4-inch services connected but are limited to a total number of 5, 4-inch diameter lateral services.
6. New taps into manholes shall be core drilled and installed with a flexible rubber boot.
7. Sewer laterals shall not cross property lines.
8. Each separately owned structure requires a separate tap to a public sewer.
9. Pool backwash shall be tied into sanitary sewer. Discharge from backwash into sewer must be by pumping, not gravity. Draining of entire pool into sanitary sewer system shall not be allowed.
10. Carwash drain shall be tied into sanitary sewer. The drain shall be placed such that it will not collect rainwater and should be located under a roof, with the area beyond the roof sloping away from the drain. The drain line shall contain a grit separator and oil/water separator.
11. Dumpster pads for food service establishments and all establishments utilizing a compactor shall have a drain connected to the sanitary sewer. The areas beyond the dumpster/trash compactor pad shall be sloped to drain away from inlet.
    i. Dumpster pads with drains shall be completely covered. Roof shall be no greater than 2-feet above dumpster screen wall/fence to minimize wind-blown rain into the dumpster area.
    ii. Compactors shall be hard piped directly to sanitary sewer system. Discharge into open drain shall not be allowed.

B. Slope

1. Laterals shall connect at 45-degrees into the sanitary main and shall be installed at the following minimum grade:
    i. 4-inch diameter: 2% minimum slope
    ii. 6-inch diameter: 1% minimum slope

C. Material

1. Schedule 40 PVC shall be for 4-inch and 6-inch sanitary sewer laterals that have 3-feet of cover and are less than 10-feet deep.
2. Sanitary sewer laterals with less than 3-feet of cover or greater than 10-feet in depth shall be DIP and include a ductile iron wye for the cleanout stack. Location and angle of fittings shall be as shown in the standard detail drawings.
3. Sewer cleanouts located in paved areas, which bear vehicle loading shall have ductile iron risers, ductile iron fittings and a traffic rated cast iron cover assembly.
4. Any material transition shall occur within 5-feet of the building face.

D. Location

1. 4-inch lines shall tap sewer mains instead of manholes where possible (exception would be cul-de-sacs). 6-inch taps and larger will require a manhole at the sanitary sewer main.
2. Direct sewer service taps shall not be allowed on existing vitrified clay pipe or sewer mains 15-inches in diameter or larger, except by manhole connection.
3. Service connections to the main lines shall be perpendicular to the main line and shall extend to the edge of the right of way or easement line.
4. Service lines connected to manholes shall not be through the cone section or manhole joints. For 6-feet diameter and larger manholes, no service is allowed in the reduced diameter riser section of the manhole.
5. Service lines shall be installed 6-inches above, but no higher than the crown of the outgoing pipe or a standard drop shall be installed.
6. Sewer laterals shall not be located in easements when gravity service can be provided to the property frontage at the street.
7. The use of in-line wyes for service connections shall be required for all new construction. When connecting to existing sewer mains, service saddle taps will be allowable. ALL in-line wyes and taps shall have the service lateral at 45-degrees from horizontal position and shall not be top taps. Wye cleanouts shall be installed at the right-of-way line or at the sewer easement line. Use of combinations are not permitted.
8. Saddle taps into existing PVC mains shall be made at 45-degrees from horizontal position of the main with the wye saddle angled 45-degrees towards the direction of flow in the main. Taps shall only be made by a mechanical circular cutting saw providing a smooth and uniform cut for the saddle installation.

E. Cleanouts

1. Cleanouts shall be installed according to the Durham County details.
2. When cleanouts are necessary in traffic areas, they shall be heavy duty traffic bearing cleanouts.
3. Cleanouts that are not traffic bearing are to be flush with the ground with a 12-inch by 12-inch by 6-inch concrete (3000-pounds per square inch (psi) minimum) protective collar.
4. The maximum spacing between cleanouts is 75-feet.

III. Manholes

A. General

1. Manholes shall be used when sanitary sewer lines change slope or direction or when sanitary sewer lines 6-inch and greater intersect.

2. Manholes shall be spaced no greater than 400-feet apart.
3. When connecting a new sewer main to an existing main, the connection shall be established with a "Doghouse" type of manhole inserted over the existing main. Doghouse manholes are not allowed on existing vitrified clay pipe. Vitrified clay pipe shall be replaced from the upstream manhole to the downstream manhole.
4. The maximum flow deflection angle in a manhole shall be dependent upon pipe size as shown in the following table. Sufficient drop shall be provided in the manhole to compensate for energy loss caused by the change of alignment. Calculations may be required.

Maximum Allowable Flow Deflection	
Pipe Size (Largest Pipe Controls)	**Maximum Deflection Angle Per Manhole**
8 to 12-inch diameter	90 degrees
15 to 18-inch diameter	75 degrees
24-inch or greater	60 degrees

B. Diameter

1. Manholes shall be sized as shown in the following table. Larger diameters may be required depending on the number of lines entering the manhole and the angle of lines entering the manhole.

Manhole Diameter		
Size of Sewer Main	**Manhole Depth (Rim to Invert)**	**Manhole Diameter**
8 to 15-inch	< 16-feet deep	4-feet
8 to 15-inch	16-feet or deeper	5-feet
18-inch or larger	Any	*

*Contact Durham County

2. All manholes 5-feet in diameter shall be extended to surface elevation with no further reduction in diameter until the eccentric cone section.
3. Manhole transitions for 6-feet and larger diameter manholes are only allowed in the top 5-feet of the manhole. In no case shall the smallest barrel size be less than 5-feet diameter. At least 5-feet of vertical clearance shall be maintained above the pipe crown before transitioning to a smaller diameter riser, or transition shall not be utilized. An eccentric flat slab reducer from 6-feet diameter or larger manhole base sections to a 5-feet diameter riser (non-paved areas) or eccentric cones (paved areas) shall be used to make any transition.
4. Manholes outside of paved areas that are 6-feet in diameter and greater and are too shallow to maintain 5-feet of vertical clearance above the crown of the pipe shall maintain the full manhole diameter up to the design surface elevation and be provided with a flat top slab cover with eccentric hole.
5. Manholes inside of paved areas that are 6-feet in diameter and greater shall be constructed with an eccentric, flat top reducer to a 5-feet diameter and provided with a 5-feet diameter eccentric, tapered cone at the finished grade. When the depth of the manhole is too shallow

to maintain 5-feet of vertical clearance above the crown of the pipe a 3-feet tall eccentric, tapered cone shall be used without any additional 5-feet diameter risers.

6. A minimum of 5-foot diameter manhole is required at all drop connections.

C. Material

1. Brick and mortar inverts shall be utilized for the flow channel through the manhole. The channel shall conform to the shape and slope of the entering/exiting sewer line and have a uniform and smooth finish free of irregularities or obstructions.
2. Manholes required to be higher than 2-feet above finished grade shall be constructed with flat top manholes.
3. Manholes shall be vented at least every 100-feet or every other manhole, whichever is greater.
4. Anti-flotation design measures shall be implemented as required in flood prone areas.

D. Invert and Rim Elevations

1. The minimum separation of invert-in to invert-out within a manhole is 0.20-feet.
2. The maximum separation of invert-in to invert-out within a manhole is 0.50-feet unless one of the following apply:
    i. An inside drop connection is provided. See Section III.E Drop Connections below for further information.
    ii. Utilizing a doghouse manhole.
    iii. Connecting to a larger diameter sewer main. See Section III.D.4.
3. Free falls of wastewater flow into the manhole invert from incoming sewer mains shall not be allowed.
4. When connecting to manhole where downstream pipe is 4-inches in diameter larger than the proposed pipe, pipes shall match crowns.
5. Manhole rim elevations shall be as follows:
    i. **Roadways:** Manholes installed in roadways and road shoulders shall be installed with the cover flush with the top of pavement.
    ii. **Outside of Roadways but in a Well-Maintained Area:** Manholes installed outside of roadways but in well-maintained areas shall be elevated at least 1-foot above the surface grade unless otherwise noted.
    iii. **Wooded Outfalls:** All manholes installed in wooded, forested, or brushy areas shall be elevated at least 3-feet above surface elevation.
    iv. **100-Year Flood Zone:** The 100-year flood elevation shall be noted on overall utility plan and utility profiles. All manholes shall be installed 2-feet above the 100-year flood elevation. If rim elevation is required to be greater than 3-feet above ground, seal top manholes with vents shall be required. Vents shall extend 2-feet above the 100-year flood elevation.

E. Drop Connections

1. In the event that drop manholes are required, they shall be constructed with an inside drop connection (outside drops are not allowed). The entire drop and upstream pipe shall be ductile iron pipe.
2. Drop connections are required when the difference between invert-in and invert-out is greater than 0.5-feet. While certain physical constraints may dictate the need for drop manholes, they may not be used merely to decrease trenching depth. Upstream slope changes shall be used to avoid the need for drop manholes.

3. The minimum difference between the upper and lower inverts of the drop is 2.50-feet for 8-inch diameter sanitary sewers. Lines larger than 8-inch will require more height.
4. A drop connection shall not be greater than 8-feet in a single manhole. If a drop greater than 8-feet is required, multiple drop connection manholes will be required with a minimum separation between manholes of 15-feet.
5. The drop connections should be labeled on profile view.

IV. Separation

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A. Separations from the sanitary sewer system shall be in accordance with 15A NCAC 02T .0305 (f) unless specified below
   1. Water (Domestic, Fire, or Reclaimed):
      i. Vertical: 24-inch (sewer below water)
      ii. Horizontal: 10-feet (Domestic and Fire) or 5-feet (Reclaimed)
      iii. If unable to maintain either of these separations or sanitary sewer crosses above water, both lines shall be made of DIP
   2. Storm Drainage
      i. Vertical: 24-inch (sewer below storm)
      ii. Horizontal: 8-feet
      iii. If unable to maintain either of these separations or sanitary sewer crosses above storm drainage, sewer shall be made of DIP.
   3. Building/Retaining Wall Foundations:
      i. Vertical: Ensure building foundations are outside the angle of repose.
      ii. Horizontal: 15-feet
B. The void space between the pipe crossings shall be backfilled with 3000-psi concrete or quick setting, minimum 500-psi, non-excavatable flowable fill that meets or exceeds NCDOT Specifications.
C. Under no circumstance shall the minimum separation be less than 8-inches for any utility crossing.

V. Easements

A. General

1. Easements shall be named "__-ft Durham County Sanitary Sewer Easement". Durham County sewer easements shall contain only Durham County utilities unless otherwise approved during construction plan review.
2. Approval of the sanitary sewer main extension shall be contingent upon the procurement of all necessary easements.
3. Easements must be seeded and strawed upon completion of construction.
4. Where required, a storm drainage pipe shall be installed across the sanitary sewer easement. The size of the pipe shall be determined using the 10-year storm event when it does not create a flooding problem. Durham County reserves the option to require an additional analysis based on a larger storm event and subsequent increase in storm pipe size.
5. Stormwater pipes shall not directly discharge into a Durham County Easement. Stormwater piping shall be extended fully across the Easement.
6. Utilities crossing a Durham County Easement shall cross no greater than 30-degrees from perpendicular.

B. Size

1. Public sanitary sewer easements shall be a minimum of 30-feet wide. A 40-feet wide easement shall be required for sanitary sewer between 15 to 20-feet of depth. A 50-feet wide easement shall be required for sewer between 20 to 25 feet in depth.
2. Private sewer main easements shall be no less than 20-feet and may be greater depending upon the depth and location.
3. Private sewer service easements shall be no less than 20-feet.

C. Location

1. All public sanitary sewer easements shall be located in open space. No permanent structures, equipment, retaining walls, embankments, impoundments, or other elements that would inhibit maintenance operations shall be constructed within a sewer main easement.
2. Sewer easements shall be graded smooth, free from rocks, boulders, roots, stumps, and other debris. No landscaping is allowed in existing or proposed sanitary sewer easements. Earthwork may be allowed with Durham County approval. All earthwork must be completed before sanitary sewer is installed.
3. Building setbacks shall be a minimum of 5-feet from all sanitary sewer easements where the depth to invert is less than 15-feet. If depth to invert is greater than 15-feet the building setback shall be a minimum of 10-feet.
4. All sanitary sewer easements shall be drivable:
    i. Max longitudinal slope = 5:1 (H:V)
    ii. Max cross slope = 10:1 (H:V)
5. Durham County Utilities may allow fences across easements provided that appropriate access gates have been installed to allow utility maintenance. In all cases, Durham County Utilities staff shall have access to secured access gates.
6. Fill or cut slopes are not allowed to extend into easements without full development plan approval. In all cases where fill material is added above existing sewer mains, the Engineer of Record shall prepare a structural analysis of the existing pipeline and determine if it is capable of supporting additional loading. If the additional fill material exceeds AWWA, DIPRA, UNIBELL and/or other manufacturer standards for loading, the pipeline shall either be reinforced to adequately support the additional loading or replaced with a ductile iron pipe rated to support the additional loading.
7. No sediment traps, including temporary, shall be located in sanitary sewer easements or around manholes.
8. All pre-existing or planned conditions as noted above that would impact operations and maintenance within the easement shall be noted and disclosed to Durham County Utilities during the site plan approval process. Typical submittal shall be a plan and profile. Any pre-existing conditions that are not disclosed during site plan review may nullify the approval and require relocation of the sewer easement where there are no existing conflicts.

VI. Encasements

1. Encasements for mains are required for crossing NCDOT roads/streets and may be required for crossing City of Durham roads/streets. NCDOT and the railroads may have more stringent requirements. The pipe is required to have restrained joints under the road area. The jack & bore pit size shall be shown and labeled on the construction plans.

VII. Creek Crossings (Aerial)

1. Aerial crossings shall only be utilized in cases where buried crossings are prohibited due to stream crossings, compliance with riparian buffer standards, minimizing impacts to wetlands, preventing excessive depth of installation, or as otherwise directed by Durham County.
2. Ductile iron lock-joint pipe will be required for all creek/river/aerial crossings. Concrete supports and/or piers will also be required. All aerial crossings require the pipe or casing pipe to be at least 1-foot above the 10-year flow depth and at least above the 25-year flow depth.
3. Piers shall generally be located at a uniform spacing of 20-feet or 1 pier for every joint of pipe. Piers and pier foundations shall be designed by a licensed NC Professional Engineer.
4. All pier foundation design assumptions shall be included on the plans. At a minimum, the footing design shall include: 1) the allowable soil bearing capacity, 2) design concrete compressive strength, 3) plan for reinforcing steel with sizing and location of bars, 4) force diagram including buoyant forces, stream velocity impacts, 5) depth of installation to prevent frost heaving, 6) bedding design to prevent differential settlement, and 7) factors of safety for unanticipated loads such as trees falling across the aerial crossing.
5. The soil conditions under the pier shall be evaluated by a licensed NC Geotechnical Engineer to determine if the allowable soil bearing capacity meets or exceeds the design assumptions included in the structural design. If the soil conditions fail to meet the specified bearing capacity requirements, a pile foundation shall be provided or the soils shall be undercut and replaced in conformance with the recommendations of the geotechnical engineer of record.

VIII. Force Mains and Pump Stations

A. Force Mains

1. For private force mains, the Engineer shall submit designs to Durham County Utilities and shall also conform to requirements of the State of North Carolina. The private force main shall connect to a standard gravity service cleanout at the right-of-way or easement line.
2. All force mains that are covered under the Plumbing Code shall discharge by gravity into public lines starting at the right-of-way line.
3. Manifolding proposed force mains on to existing force mains is not permitted. Pipe deflections are not allowed in force mains. Plan and profile drawings are required.

B. Pump Stations

1. All residential subdivision lots shall be serviced by gravity unless a private pump station is otherwise approved. If a pump station is approved, it shall be privately maintained. The pump and force main must have a note on the recorded plat indicating, “Privately maintained sewer pump and force main is required to serve this lot.”
2. For projects involving a sanitary sewer pump station, the applicant shall contact the Durham County Utilities prior to submittal of site plan or construction plans. This is to determine if the station is required or if there is a gravity option, whether or not the station will be public or private and to determine the designs that apply.
3. A North Carolina Professional Engineer shall sign and seal that the pump station meets NCDEQ Standards and Specifications.

IX. Sanitary Sewer Abandonment

A. Sanitary Sewer Mains and Manholes

1. When sanitary sewer mains are abandoned, 5-linear feet of sanitary sewer nearest the sanitary sewer to remain live shall be filled with concrete.
2. Abandonment of manholes shall consist of removal of manhole structures to 3-feet below finished grade, filling the manhole with concrete to an elevation of 1-foot above the crown of the pipe, filling with stone to 6-inches from top, and sealing manhole with a 6-inch concrete slab. The area of this removal shall be backfilled with clay and compacted well.

B. Services

1. Abandonment of sanitary sewer service lines shall consist of excavating down to the service connection to the main, cutting this connection and installing a watertight plug in the main. The service line and all clean-out risers on the service line shall be removed. Utility Service Abandonments will take place prior to beginning utility construction work for a project. Any excavation as part of abandoning utilities will require backfilling per Durham County standards.