

CHAPTER 12

LOW PRESSURE SANITARY SEWER DESIGN

1 **1. GENERAL**

- 2
- 3 A. This chapter covers the minimum design criteria to be used for designing low pressure
- 4 sanitary sewer (LPSS) private home or commercial pump stations, pipelines, and
- 5 appurtenances including those portions of low pressure sewer service connections that
- 6 lie in public rights-of-way and in easements granted to Charlotte Water. All other
- 7 systems are the responsibility of the respective property owner unless otherwise
- 8 documented by an agreement with Charlotte Water.
- 9
- 10 B. Low pressure sewers are only allowed in the areas designated in the *2022 Lake Area*
- 11 *Study* and generally include the areas bordering Lake Norman, Lake Wylie, and
- 12 Mountain Island Lake where gravity service would involve numerous, small lift stations.
- 13 LPSS will only be considered where a thorough study of all alternatives clearly indicate a
- 14 gravity collection and disposal system with or without a central lift station is not practical
- 15 or feasible.
- 16
- 17 C. All engineering plans for low pressure sewers must meet the Charlotte Water design
- 18 standards as presented, the State standards as indicated in the most recent amended
- 19 *Administrative Code, Title 15A, Subchapter 2T Waste Not Discharged to Surface Waters*
- 20 by the North Carolina Department of Environmental Quality (NCDEQ), and the most
- 21 current edition of the North Carolina State Plumbing Code. In general, the Charlotte
- 22 Water standards should be the primary source for design guidance with the State
- 23 standards as a supplement. In some cases, the Charlotte Water standard is more
- 24 stringent than the State standard.
- 25
- 26 D. These design standards do not apply to private home pump stations pumping into the
- 27 public gravity sewer system.
- 28
- 29 E. These design standards do not apply to Septic Tank Effluent Pump (STEP) systems.
- 30 Any proposed STEP system must be reviewed by Charlotte Water and permitted by
- 31 NCDEQ. Conversion of septic tanks for use with a low pressure sewer system must first
- 32 be approved by the Mecklenburg County Water Quality Program.
- 33
- 34 F. Inspection and testing by a Charlotte Water inspector will be required of the new LPSS
- 35 system prior to acceptance of the system.
- 36

37 **2. SUBMITTAL REQUIREMENTS**

- 38
- 39 A. All low pressure sewers must be designed by a professional engineer licensed in the
- 40 state of North Carolina and submitted to NCDEQ and Charlotte Water for technical
- 41 review and approval for conformance to *15A NCAC 02T Section .0300 Sewer*
- 42 *Extensions* and utilizing the most current *Form ASEA: Alternative Sewer Extension*
- 43 *Application with Supporting Documentation*.
- 44
- 45 B. In addition to the application documentation required under Paragraph 2.A, the Engineer
- 46 of Record shall provide Charlotte Water a Customer Information Packet that shall
- 47 include:

- 1
- 2 1) Installation Checklist
- 3
- 4 2) Maintenance Checklist
- 5
- 6 3) Commonly asked questions and answers
- 7
- 8 4) Typical installation drawings
- 9
- 10 5) Pump manufacturer's literature such as pump curves, features, and specifications
- 11
- 12 6) List of all lots to be served by the proposed system with the following information:
- 13
- 14 a. Address
- 15
- 16 b. Tax parcel number
- 17
- 18 c. Pump elevation
- 19
- 20 d. Pump design point
- 21
- 22 e. Pump on/off float switch elevations
- 23
- 24 f. High level alarm float elevation
- 25
- 26 g. Top of the wet well elevation
- 27
- 28 h. Ballast data (dimensions, material)
- 29

30 **3. HYDRAULIC DESIGN**

31 **A. Calculating Flows**

- 32
- 33
- 34 1) Flow analysis shall include a sewer basin map showing the project's total potential
- 35 sewer area and downstream connection to an existing sewer.
- 36
- 37 2) Populations to be served shall be calculated from Future Land Use (FLU) plans for
- 38 the sewer basin. Population may include residential, commercial, industrial, and
- 39 institutional categories. Population should be estimated based on developable area.
- 40 Depending on complexity of the project, Charlotte Water may request the population
- 41 projection calculations. For subdivisions, populations may be based on planned lots
- 42 to be built in the subdivision including all future phase lots.
- 43
- 44 3) For service areas tributary to the collection system(s) that are provided treatment
- 45 through the Charlotte Water treatment facilities, the Average Daily Flow (ADF) will be
- 46 190 gallons per day (GPD) per single family residential dwelling unit and 135 GPD
- 47 per multi-family residential dwelling unit. For service areas tributary to the collection
- 48 system that is provided treatment through interconnection with the Water and Sewer
- 49 Authority of Cabarrus County (WSACC), the ADF for both single and multi-family
- 50 dwelling units shall be 65 GPD per bedroom.
- 51

- 1 4) Commercial, industrial, and institutional unit flow rates should be per *15A NCAC*
2 *02T.0114* or project specific where data is available. Unit flow rates below the State
3 minimum are not allowed without written approval from Charlotte Water.
4
5 5) Peak daily flow shall be proportional to population and calculated using the following
6 equation:

$$PF = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

8
9 Where:

10 PF = peaking factor, minimum of 2.5

11 P = service population in thousands

12 13 14 15 B. System Design

- 16
17 1) Residential LPSS systems may be served by a simplex grinder pump if average daily
18 design is less than or equal to 600 gpd. Larger residential, commercial, industrial,
19 and institutional land uses must be served by a duplex grinder pump system as
20 required by State regulations.
21
22 2) A separate private pump station and lateral shall be provided for each residential,
23 commercial, industrial, or institutional building and for each parcel.
24
25 3) The private pressure sewer shall connect to the Charlotte Water maintained system
26 at a stub from the property line side of the dual ball valve/check valve assembly in
27 accordance with the service connection Standard Detail.
28
29 4) The LPSS system shall be under positive pressure at all time with the discharge
30 elevation above all intermediate high points.
31
32 5) Cleanouts/manual air release valves shall be provided at all high points along the
33 force main.
34
35 6) Cleanouts shall be provided at 500-foot intervals along mains and placed on the
36 upstream side of a main line isolation plug valve.
37
38 7) A hydraulic model of the LPSS system may be used to provide output including the
39 network layout, nodes, actual internal diameter of pipe sizes between nodes,
40 expected velocity and flow in each line segment, and TDH. Manufacturer's software
41 can be utilized; however, the Engineer of Record shall seal the model as to the
42 accuracy of the input and output values. The model shall reflect the use of the
43 appropriate average and peak flows as calculated in Section B, a Hazen-Williams
44 "C" coefficient for the pipe material used, and an allowance for minor losses
45 associated with the network. The model shall account for connections to existing

1 pressure sewer systems and not affect the operation of the existing system (i.e., shut
2 other pumps out).

- 3
4 a. A Hazen-Williams “C” coefficient of 130 to 140 may be used for PVC and HDPE.
5
6 b. Hydraulic Calculations shall demonstrate pumps selected are capable of meeting
7 TDH conditions at any proposed or potential grinder pump location.
8

9 8) The hydraulic model shall provide an initial activation, an average flow discharged
10 from the LPSS system, and a maximum flow discharged with all pumps operating.
11 The maximum flow condition will be experienced upon restoration of power following
12 a system-wide power outage.
13

14 9) The hydraulic model shall confirm the downstream capacity of the receiving gravity
15 sewer at both full-pipe flow at peak flow and half-full pipe at average flow.
16

17 **4. PRIVATE PUMPS**

- 18
19 A. Private pumps must be centrifugal design; no positive displacement pumps are allowed.
20
21 B. LPSS pump manufactures include Pentair/Myers, Keen, Xylem, or approved equal by
22 Charlotte Water.
23
24 C. The impeller diameter of individual pumps in a system with varying pump elevations
25 shall be sized such that full size impellers are used at pumps at the lowest elevations
26 and reduced size impellers are used at higher pumps such that the total TDH of any one
27 pump is within 20% of all other pumps.
28
29 D. Pressure shall not exceed pump and/or pipe pressure limitations.
30

31 **5. PRIVATE SINGLE FAMILY WET WELL**

- 32
33 A. The wet well shall be a minimum of 3 feet in diameter and a minimum of 6 feet deep and
34 be provided with a screened vent. Other sizes may be considered for individual site
35 constraints at Charlotte Water’s discretion.
36
37 B. The wet well shall be designed to prevent flotation.
38
39 C. The wet well shall provide a minimum of 240 gallons or 24 hours of wastewater storage
40 above the pump on level and under the wet well lid, no higher than 1-foot below finished
41 floor elevation unless otherwise approved by Charlotte Water.
42
43 D. In general, the wet well shall contain the grinder pump(s), pump on/off float switches,
44 high level alarm float, pump discharge pipe(s) and check valve(s). The control panel
45 shall be mounted for easy access on the building served and contain an audible and
46 visual high-water alarm.
47

1 E. Large residential, commercial, industrial, and institutional duplex lift stations are required
2 to have a standby power source and telemetry system to provide remote notification of a
3 problem condition.
4

5 **6. PUBLIC LOW PRESSURE MAINS**
6

7 A. Minimum pipe size is 2 inches; maximum pipe size is 4 inches. Service lines shall be
8 provided per the standard details.
9

10 B. Minimum velocity in any pipe segment shall be 2 fps with a minimum of 2 pumps
11 operating simultaneously and maximum velocity 10 fps under simultaneous pump
12 operating conditions.
13

14 C. Pipe shall be located in publicly maintained road right of way or properly recorded public
15 easements on private property at Charlotte Water's discretion.
16

17 D. Pipe shall not be located in either public or private alleys.
18

19 E. Pipe material for various size LPSS pipes is provided in Table 12.2.

Table 12.2: Pipe Material for LPSS Sewers	
Sewer Pipe Size (inches)	Material
2 - 4	PVC, SDR 13.5, ASTM D2241, IPS
2 - 3	HDPE, SDR 9, AWWA C901, IPS
4	HDPE, SDR 9, AWWA C906, IPS

20
21 F. Pipe size and material shall be listed on the design drawings.
22

23 **7. UTILITY SETBACKS AND SEPARATIONS**
24

25 The minimum clearance requirements for conflicts with utilities and other features, in
26 accordance with NCAC 02T.0305 and governing utility guidelines, is shown in Table 12.3.
27 Depth of cover shall be defined from the top of the pipe.
28

Table 12.3: Minimum Separations for Sewers per NCAC 02T.0305	
Setback Parameter	Separation Requirements*
Storm Sewers and other utilities not listed below (vertical) Where separation cannot be met, DIP or structural bridging to prevent crushing the underlying pipe shall be used.	2 feet

<p>Water Lines</p> <p>Vertical, water over sewer including in shared, benched trenches</p> <p>Horizontal</p> <p>Where a water main crosses over a sewer, one full length of water pipe shall be located so that both joints will be as far from the sewer as possible.</p>	<p>18 inches</p> <p>10 feet</p>
<p>Reclaimed Water Lines</p> <p>Vertical, reclaimed over sewer</p> <p>Horizontal, reclaimed over sewer</p>	<p>18 inches</p> <p>2 feet</p>
<p>Any private or public water supply source, including any wells, WS-I waters of Class I or Class II impounded reservoirs used as a source of drinking water (stream classifications from Division's NC Surface Water Classifications webpage)</p> <p>For public or private wells where minimum separation cannot be met, piping materials, testing methods and acceptability standards meeting water main standards shall be used. All appurtenances shall be outside the 100' radius. The minimum separation shall however not be less than 25' from a private well or 50' from a public well.</p>	<p>100 feet</p>
<p>Waters classified WS (except WS-I or WS-V), B, SA, ORW, HQW, or SB from normal high water (or tide elevation) and wetlands (stream classifications from Division's NC Surface Water Classifications webpage)</p>	<p>50 feet</p>
<p>Any other stream, lake, impoundment, or ground water lowering and surface drainage ditches</p>	<p>10 feet</p>
<p>Any building foundation</p>	<p>10 feet</p>
<p>Any basement</p>	<p>10 feet</p>
<p>Top slope of embankment or cut of 2 feet or more vertical height</p>	<p>10 feet</p>
<p>Drainage systems and interceptor drains</p>	<p>5 feet</p>
<p>Swimming pools</p>	<p>10 feet</p>
<p>Final earth grade (vertical)</p> <p>Where minimum cover cannot be met, DIP casing pipes shall be used. Where sewers are subject to traffic bearing loads, pipe with proper bedding to develop design supporting strength shall be provided.</p>	<p>5 feet</p>

For all other separations, materials, testing methods, and acceptability standards meeting water main standards (15A NCAC 18C) shall be required in any alternative.

Table 12.4: Minimum Separations for Sewers to Other Features

Stormwater BMP	Sewer easement remain outside 1:1 slope to the BMP easement
Retaining Wall	Sewer to remain a minimum of 5 feet from footings and outside of geogrid area/structural impact of retaining wall
Roadways and Driveways	2 feet from edge of pavement and/or back of curb measured to center of pipe

8. CORROSION PROTECTION

A corrosion resilient manhole shall be provided where the low pressure sewer discharges into a downstream manhole. Corrosion protection may include protective coatings on exposed concrete surfaces, concrete additives, or polymer concrete structures at Charlotte Water's discretion.

9. DESIGN OF EROSION AND SEDIMENT CONTROL MEASURES

Regardless of size, all LPSS projects shall include measures and/or devices to prevent erosion and to contain sediment within the limits of the right-of-way and/or proposed easements. Design and permitting of erosion and sediment control devices shall be in accordance with Charlotte Land Development Standards including the City of Charlotte Soil Erosion and Sedimentation Control Ordinance for Developer-Donated projects. Charlotte Water designed projects shall meet NCDEQ requirements, as outlined in the North Carolina Erosion and Sediment Control Planning and Design Manual. Projects outside of City limits but within Mecklenburg County or outside of Mecklenburg County shall follow the appropriate county, town, and/or state requirements.

END OF SECTION

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