BRUNSWICK COUNTY
Wastewater Pumping Station Design Guidelines

Brunswick County Engineering Department – Contacts

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Submittal Process

A private development company (Developer) who desires to connect to the Brunswick County wastewater system using a pump station to be dedicated to the County shall follow the guidelines presented herein for submittal, approval, and acceptance by Brunswick County. Developers of privately owned pump stations (non-County owned) in which the NCDENR sewer permit and Operation & Maintenance Agreement are in the Developer's name shall be required to meet the appropriate portions of these guidelines. Where the term "Developer" is used, it refers to the persons, entities, representatives, or engineers responsible for the land development.

The following is an overview of the process for design of pump stations to be dedicated to the County:

1) ***Pre-Design Conference*** – This conference will be held to determine wastewater needs and other requirements pertinent to the proposed project.

2) ***Design Submittal Package*** – The Developer will be required to submit a full design package to Brunswick County for review and comment by Brunswick County staff.

3) ***Final Design Submittal Package*** **-** The Developer shall incorporate changes and comments as provided by Brunswick County and resubmit a final design package for approval by Brunswick County staff.

4) ***Construction & Final Acceptance*** – Upon approval by Brunswick County and acquisition of all necessary state, local, and federal permits, and a pre-construction meeting with Brunswick County Engineering Department staff the Developer may construct the approved infrastructure. Brunswick County Engineering Department staff shall review and inspect the construction during and after completion of construction. Once the infrastructure improvements are complete and meet Brunswick County standards, the Engineering Department will issue Substantial Completion in anticipation of final Deed and Dedication.

Note on Private Pump Stations – The section "Construction and Final Acceptance" noted above is not applicable to Developers of privately owned pump stations (non-County owned) in which the NCDENR sewer permit and Operation & Maintenance Agreement are in the Developer's name. Additionally, Design Parameters (section 3.31) that only affect sewer system improvements to be owned, maintained, and/or operated by the Developer may not be applicable. However, Developers constructing private pumping stations are strongly encouraged to follow Brunswick County's Wastewater Pumping Station Design Guidelines.

A detailed guideline for the submittal process is provided as follows:

SECTION 1 – PRE-DESIGN CONFERENCE

Section 1.1 Requirements

The Developer shall schedule and attend a Pre-Design Conference with the Brunswick County Engineering Department to determine project requirements. The Developer shall provide the following information to Brunswick County Engineering Department staff a minimum of 14 days prior to the Pre-Design Conference:

- Map denoting location of proposed project. The map must clearly indicate the Parcel Identification Number, property lines, and road names.
- Brief description of proposed project.
- Estimated Wastewater Demand of proposed project per 15A NCAC 02T .0144. If a daily design flow parameter is not provided in 02T .0144 applicable to the Developer's project, Developer shall submit calculations of how estimated wastewater demand was derived.
- Location of the proposed project's connection to the existing wastewater system.

The Developer should come to the meeting prepared to discuss potential locations of the proposed pump station(s) on the property and the type of collection system proposed (for example, gravity, low pressure, combination, etc.). Please note that gravity collection systems are required "unless proven otherwise unfeasible by the Developer/Owner or the Developer's/Owner's engineer to the satisfaction of the County" (Sewer Use Ordinance, Section 4.2).

After the Pre-Design Conference, Brunswick County will provide a letter to the Developer with the following information:

- The need (if applicable) for Regional Wastewater Pump Stations.
- The need (if applicable) for additional infrastructure improvements due to impacts to existing infrastructure caused by the proposed project.
- Hydraulic Grade Line information for design of the proposed project and for connection to the Brunswick County wastewater system.
- The type of collection system to be used on the project or specific information needed for County staff to determine the collection system type to be used.
- The specific location or general area for location of the pump station.
- Any other design parameters agreed to at the Pre-Design Conference.

SECTION 2 – DESIGN SUBMITTAL PACKAGE

Section 2.1 General

The Developer shall submit a complete design package for the proposed project to Brunswick County for review and comments. The design package shall include (as a minimum) the following components.

- Design Report & Checklist.
- Complete plans and specifications sealed by a licensed PE in North Carolina.
- Completed permit applications .
- Hydraulic calculations utilizing standard format indicated on spreadsheet supplied by Brunswick County. Calculations shall be sealed by a licensed PE in North Carolina.
- Copies of proposed manufacturer's pump curves including "Total System Head" curves superimposed on each pump curve for each pump station submitted.
- SewerCad model results (if required by County staff).

Section 2.2 Design Submittal Requirements

The design of proposed wastewater pump stations shall adhere to the following basic requirements:

1) **Design Report:**
   - Submit a *Design Submittal Checklist* as provided by Brunswick County. See also NCDENR Division of Water Quality Construction Grants and Loans Section "Fast Track Audit Checklist."
   - General Project Overview & Description of Pump Station Configurations.
   - Summary of Wastewater Needs (Calculation of demands by type, etc. per 15A NCAC 02T .0114 or substantiation of estimated demands if not per 02T .0144).
   - Summary of Calculations & Findings to include:
     - Proposed Pump Station Data (Design Points, Operational Points, TDH, Horsepower, RPM, Proposed Pump Make and Model, Impeller Size, etc.).
     - Calculated Peaking Factors.
     - Discussion of Impact to Existing System and upgrades/modifications proposed to mitigate the impact. The "Existing System" shall also include permitted sewer infrastructure improvements not yet constructed. This shall address maximum system pressures, maximum system velocities, pump station capacity, etc.

2) **Complete Plans & Specifications**
   - Plans must comply with all applicable state, local, and federal regulations. Additionally, for pump stations that will be owned, maintained, and/or operated by the County, plans must comply with current Brunswick County standards and specifications.
   - Plans must be sealed by licensed North Carolina Professional Engineer. These may be marked "For Review Only – Not For Construction" for the initial Design Submittal. For pump stations that will be owned, maintained, and/or operated by the County, deviations from Brunswick County standard specifications must be clearly indicated in the Supplementary General Conditions.

3) **Completed Permit Applications**
   - All permit applications necessary for the proposed project must be completed and submitted as part of the design package. These shall include, at a minimum, all NCDENR sewer permits (Fast-Track, Low Pressure, etc.) and 3-Party NCDOT Encroachment Applications. Other items may include CAMA Permits, FEMA Compliance, NCDOT Driveway Permits, State and Local Stormwater Permits, etc.

- Where required (i.e., NCDENR Fast-Track Application), permit applications must be sealed by a licensed North Carolina Professional Engineer. The signing official for Brunswick County shall be the County Manager.

4) Hydraulic Calculations

- Hydraulic calculations must be sealed by a licensed North Carolina Professional Engineer. These may be marked "For Review Only – Not for Construction" for the initial Design Submittal. Any deviations from the standard calculation spreadsheet or additional calculations must be documented in the Design Report.
- Developer will utilize the same format as indicated in the Brunswick County basic "Wastewater Pump Station Calculations" spreadsheet.
- If required by Brunswick County staff, output data from the SewerCAD XM model shall be submitted as supporting documentation.

5) Proposed Manufacturer's Pump Curves

- For pump stations that will be owned, maintained, and/or operated by the County, pumps must be selected from Brunswick County list of approved wastewater pumps.
- Pump curves shall indicate design flow rates, operating points, and Total Dynamic Head (TDH).
- System Curves shall be indicated on pump curves for the following operating conditions:
    - Proposed pump station operating independently of all other pump stations in the system.
    - Proposed pump station operating in parallel with all existing or future pump stations in the Brunswick County wastewater system.

Subsequent submittals shall be made until all comments by Brunswick County staff are addressed. The final set of plans, specifications, and calculations must indicate that they are "Final" and appropriate for bidding and construction.

SECTION 3 – BASIC DESIGN PARAMETERS

Section 3.1 General

All wastewater pump stations designed for connection to the Brunswick County wastewater system that shall be owned, operated, and/or maintained by Brunswick County shall meet the requirements as stipulated in this section, current Brunswick County standards, and shall comply with all state, local, and federal regulations as applicable. Developers of privately owned pump stations (non-County owned) in which the NCDENR sewer permit and Operation & Maintenance Agreement are in the Developer's name shall not be required to meet Design

Parameters (section 3.31) that only affect sewer system improvements to be owned, maintained, and/or operated by the Developer. Specifically, these include items 4, 5, 9, and 10 in section 3.31.

Section 3.2 Information Provided by Brunswick County

After completion of the Pre-Design Conference, Brunswick County staff shall provide the following information to the Developer in writing:

- Hydraulic Grade Line (HGL) elevations at the proposed point of connection for the project. The elevations will be given for a range of wastewater flows above and below the peak design pumping rate of the proposed pump station, sufficient to determine system operating ranges for the project.
- If the proposed project connects to a manifold force main system, Brunswick County staff will provide a range of HGL elevations for two conditions:

    - Condition 1 – Proposed pump station operating alone or independent of other pump stations in the wastewater system.
    - Condition 2 – Proposed pump station operating in parallel with the other pump stations in the wastewater system.

- The need for a Regional Wastewater Pump Station or guidance regarding the existing pump station to which wastewater must be directed.
- If analysis by Brunswick County staff indicates that the proposed pump station has significant adverse impacts to the existing sewer system (including permitted infrastructure improvements not yet constructed) that must be mitigated, Brunswick County staff will notify the Developer of such impacts so that the Developer may design, construct, and fund upgrades necessary to mitigate the adverse impacts.
- Size and material of the infrastructure at the connection point to the wastewater system.
- Copies of any available Record Drawings of the existing infrastructure associated with the connection point to the wastewater system.
- A preliminary determination of wastewater treatment capacity availability. Wastewater treatment capacity is not allocated until the County signs all NCDENR permits, provides signed NCDENR DWQ Flow Tracking/Acceptance forms, and approves all plans and specifications. Wastewater treatment capacity is not guaranteed until issuance of all building permits.
- When available, the force main size shown on the latest Wastewater Master Plan.
- For collection systems to be owned, maintained, and/or operated by the County, the type of collection system to be used on the project or specific information needed for County staff to determine the collection system type to be used.

- For pump stations that will be owned, maintained, and/or operated by the County, the specific location or general area for location of the pump station.
- Any other design parameters agreed to at the Pre-Design Conference.
- Electronic file of SewerCAD hydraulic model (if requested by Developer or required by County staff).

Section 3.3 Design Requirements & Guidelines

Design of wastewater pump stations for the Brunswick County wastewater system shall meet the following criteria:

3.31 Design Parameters

1) Hydraulic calculations shall be performed using the same format as used in the Brunswick County "Wastewater Pump Station Design Calculations" *Excel* spreadsheet. The Engineer is responsible for ensuring the validity of calculations performed using any Brunswick County-supplied spreadsheets. Additional calculations may be submitted by the Engineer if necessary. The Engineer shall notify Brunswick County staff if formulas in Brunswick County-supplied spreadsheets deviate from standard practice or NCDENR guidelines.

2) Calculate Ultimate Flow for Pump Station. Ultimate flow includes flow from the entire parcel(s) to be served and all phases of the proposed development. Brunswick County staff may provide input into the ultimate flow determination based on the wastewater needs tributary to the pump station. Interim flow values may be determined for pump stations serving large developments that must be phased in order to meet design requirements. Note the following Brunswick County requirements for determining wastewater flow:
   - 210 GPD/3-Bedroom House located in the County service area and served by the West Brunswick Wastewater Treatment Plant, Carolina Shores WWTP, Sea Trail WWTP, or Shallotte WWTP. All other areas shall utilize the NCDENR 2T Regulations of 360 GPD/ 3-Bedroom House.
   - Non-residential wastewater flows shall be in accordance with NCDENR 2T regulations.
   - Peaking Factor shall be as per the formula required by NCDENR 2T Regulations.

3) Determine required force main diameter. The minimum allowable force main size is the larger of the following:
      - 4"
      - The size indicated on the latest Wastewater Master Plan.
      - The size required by the Director of Public Utilities.

Pumps and force main systems must be designed to provide a minimum velocity of 2 feet per second. Maximum velocity for a new force main shall be limited to 5 feet per second, unless otherwise approved by Brunswick County.

4) Wetwell shall be sized to accommodate this ultimate flow or the Brunswick County minimum size, whichever is greater. The minimum wetwell size shall be determined as follows:

Average Daily Flow (GPD)	Minimum Wetwell Diameter
0 – 450,000	8 Ft
450,001 – 700,000	10 Ft
700,001 – 1,000,000	12 Ft (or Equivalent Design)
>1,000,001	Design

*Note minimum depth of wetwell from top of slab to wetwell invert shall be 19 feet. Other depths may be allowed with written consent by the Director of Public Utilities.

- Determine Wetwell Depth and float levels as follows:
    - Pumps Off = 11 Feet below lowest invert in elevation
    - Lead Pump On = Pumps off elevation plus required vertical cycle height
    - Lag Pump On = 1 Foot above Lead Pump On
    - High Water Alarm = 1 Foot above Lag Pump On and a minimum of 2 Feet below Lowest Invert In
    - Bottom Invert Elevation of Wetwell = As recommended by pump manufacturer to prevent vortexing within the wetwell and maintain minimum pump submergence, but in no case less than 4 Feet below Pumps Off
    - Cycle time calculations shall be provided for both Ultimate Flow and Interim Flow (if applicable) to the pump station. Both ultimate and interim flow cycle time conditions shall adhere to 2-8 cycle per hour requirements per NCDENR 15A 2T regulations. Removable Baffles may be used for interim flow conditions in order to meet this requirement.

5) Minimum depth of pump station receiving manhole is 5′.

6) The "Wastewater Pump Station Design Calculations" spreadsheet provides the following design parameters:

- Utilizes Hazen-Williams ‘c’ value of 130.
- Adds 5% to force main length to account for fittings and minor losses. Other means of minor loss evaluation may be considered upon approval by Brunswick County staff.
- Determines equivalent length of wetwell piping (separate of minor losses).
- Static Head is calculated as the highest point along the force main route or the connection point elevation (provided by Brunswick County), whichever is most appropriate, less the “Pumps Off” elevation of the wetwell.
- Calculations include System Curves for manifold and non-manifold conditions.
- Deviations from the spreadsheet to accommodate unique conditions may be acceptable; however, notification of Brunswick County staff for such deviations is required. Deviations and additional calculations shall be noted in the Design Report.

7) Force Main pressures may not exceed 100 pounds per square inch (psi) in the wastewater system for existing, existing not yet constructed, and proposed infrastructure.

8) Pipe velocities shall be between 2 feet per second and 5 feet per second. Deviations from this requirement require approval by Brunswick County staff.

9) Pumps shall be selected from the Brunswick County approved list and shall meet the requirements of the Brunswick County standard specifications. Some specific items relevant to initial pump station design include the following requirements (deviations from Brunswick County requirements require prior approval of Utilities Department):

- Submersible, non-clog, solids handling, capable of passing a 3-inch spherical solid.
- 3-Phase – 277/480 Volt power shall be required for all motors in excess of 10 Horsepower. Deviations from this requirement must be approved in writing by Brunswick County.
- In situations where 3-Phase power is not readily available then motors 10 horsepower and under may be 120/240 Volt Open Delta (High Leg).
- Standard Size Impeller, preferably the pump and impeller combination chosen will allow for impeller upgrades in the future.
- Electrical infrastructure shall be sized for the entire parcel(s) to be served and all phases of the proposed development (ultimate flow). Services and facilities shall be sized for the full range of impellers available for the selected pump.
- Brunswick County staff acknowledges that various operating conditions are possible within the wastewater system; therefore, options have been provided to accommodate such varying conditions. Pumps & Motors for pump stations shall be evaluated/selected in the following order of preference:

  - First Option (Preferred): *Maximum constant motor speed of 1800 RPM*
  - Second Option: *Maximum constant motor speed of 3600 RPM*
  - Third Option: *Variable Frequency Drives (VFD's) or two-speed pumps with the written consent of the Director of Public Utilities*

  Note that Brunswick County staff approval is required for the second and third options noted.

- A separate, climate controlled, electrical building to house all electrical panels and pump control panels shall be provided for constant speed motors in excess of 50 horsepower.
- A separate, climate controlled, electrical building to house all electrical panels, VFD's, and pump control panels shall be provided for motors operated by VFD's 25 horsepower or larger.
- For all motors operated by VFD's less than 25 horsepower, the VFD's shall be provided with a self-contained, ventilated and/or air conditioned cabinet.
- Motor Horsepower shall be non-overloading for maximum impeller diameter of selected pump and of a commercially available size.

10) Pumps shall be selected for highest head conditions of all scenarios unless otherwise approved by County staff in writing.

All pump stations shall be evaluated for odor control requirements and anti-flotation. All pump stations shall be constructed with wetwell corings and piping to accommodate odor control systems. Odor control systems shall be installed in accordance with State and County specifications.

SECTION 4 – CONSTRUCTION AND FINAL ACCEPTANCE BY BRUNSWICK COUNTY

Section 4.1 General

Prior to final acceptance of the wastewater pump station or associated infrastructure, the following must be completed and/or submitted to the Brunswick County Engineering Department:

- An inspection of the constructed facilities must be scheduled by the Developer with Brunswick County staff.
- All facilities must comply with Brunswick County standards and all applicable state, local, and federal regulations.
- All defective items noted in Brunswick County staff inspection must be corrected.

- A 'Start-Up' inspection of the pump station must be held as per Brunswick County requirements. A 'Pump Station Data Sheet' (provided by Brunswick County) shall be filled out and provided to Brunswick County staff.
- Copy of contractor's Utility License
- Copy of contractor's Certificate of Insurance
- Testing Results
- Indemnity Agreement
- A completed "Deed of Dedication"
- An affidavit that no liens exist for the work or infrastructure
- Fixed Assets Amount
- Recording Fees
- NCDENR certifications and Record Drawings sealed by a licensed North Carolina PE must be submitted.
- Electronic as-built drawings in AutoCad, MicroStation, or ArcView submitted to Brunswick County.

While all of the items noted above are required for Final Acceptance, many of the listed items are required for Substantial Completion prior to Final Acceptance.

END OF SECTION