ENGINEERING REPORT/

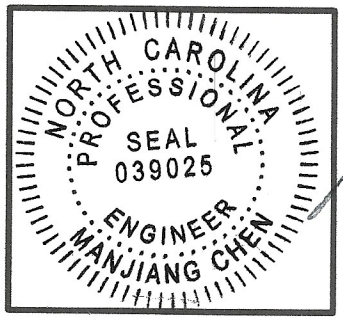
ENVIRONMENTAL INFORMATION DOCUMENT

FOR THE SOUTHSIDE (M'KEAN MAFFITT) WASTEWATER TREATMENT PLANT REPLACEMENT & CAPACITY UPGRADE PROJECT

DWI Project Number CS370923-15

CAPE FEAR PUBLIC UTILITY AUTHORITY
PWSID 04-65-010

235 Government Center Dr
Wilmington, NC 28403
910-332-6550



9/6/2024

Prepared by
Manjiang Chen, PhD, PE

McKIM&CREED

243 North Front Street
Wilmington NC 28401
Firm # F1222
910-343-1048

M&C Project Number 03385-0017

Table of Contents

Section 1.0 Executive Summary
Section 2.0 Current Situation
Table 2.1. Overview of Collection System
Table 2.2. General WWTP Condition
Table 2.3.1. Specific Equipment Description – Bar Screens
Table 2.3.2. Specific Equipment Description – Primary Clarifiers
Table 2.3.3. Specific Equipment Description – Primary Sludge Pump Station
Table 2.3.4. Specific Equipment Description – Trickling Filters
Table 2.3.5. Specific Equipment Description – Aeration Tank
Table 2.3.6. Specific Equipment Description – Intermediate Pump Station
Table 2.3.7. Specific Equipment Description – Secondary Clarifiers
Table 2.3.8. Specific Equipment Description – RAS Pump Station
Table 2.3.9. Specific Equipment Description – WAS Pump Station
Table 2.3.10. Specific Equipment Description – Recirculation Pump Station
Table 2.3.11. Specific Equipment Description – UV Disinfection
Table 2.3.12. Specific Equipment Description – Discharge Piping
Table 2.3.13. Specific Equipment Description – Gravity Belt Thickeners
Table 2.3.14. Specific Equipment Description – TWAS Storage Tank
Table 2.3.15. Specific Equipment Description – Anaerobic Digesters
Table 2.3.16. Specific Equipment Description – Belt Filter Press
Table 2.3.17. Specific Equipment Description – Lime Stabilization System
Table 2.3.18. Specific Equipment Description – Filtrate Pump Station
Table 2.3.19. Specific Equipment Description – Offsite Sludge Disposal
Table 2.4. NPDES Permit Information
Table 2.5. Current Population Analysis
Table 2.6. Historical Wastewater Flow Data
Section 3.0 Future Situation
Table 3.1. Future Population Analysis
Table 3.2. Future Flow Analysis
Table 3.3. SSWWTP Flow and Peaking Factor Data
Table 3.4. SSWWTP Influent Design Flow and Loads for 16 MGD
Table 3.5. SSWWTP Influent Design Flow and Loads for 20 MGD and 24 MGD
Section 4.0 Need and Purpose
Section 5.0 Alternative Analysis
Section 5.1. Alternatives Description
Table 5.1.1. Alternatives Description – No Action Alternative
Table 5.1.2. Alternative Description – Densification with Anaerobic Sludge Digestion (Preferred Alternative)
Table 5.1.3. Alternatives Description – Optimum Operation of Existing Facilities
Table 5.1.4. Alternatives Description – Decentralized Systems
Table 5.1.5. Alternatives Description – Regionalization
Table 5.1.6. Alternatives Description – BioDenipho with Thermal Sludge Drying
Section 5.2. Present Worth Analysis
Table 5.2.1.1. Capital Costs – Preferred Alternative
Table 5.2.1.2. Project Cost Life Cycle Assumptions
Table 5.2.1.3. Replacement Costs (Years 1 to 5)
Table 5.2.1.4. Replacement Costs (Years 6 to 10)
Table 5.2.1.5. Replacement Costs (Years 11 to 15)
Table 5.2.1.6. Replacement Costs (Years 16 to 20)
Table 5.2.1.7. Present Value of Operations & Maintenance Costs (Years 1 – 10)
Table 5.2.1.8. Present Value of Operations & Maintenance Costs (Years 11 – 20)
Table 5.2.1.9. Present Value of Intermittent Operations & Maintenance Costs (Years 1 – 10)
Table 5.2.1.10. Present Value of Intermittent Operations & Maintenance Costs (Years 11 – 20)
Table 5.2.2.1. Capital Costs – BioDenipho & Thermal Sludge Drying
Table 5.2.2.2. Project Cost Life Cycle Assumptions

Table 5.2.2.3. Replacement Costs (Years 1 to 5)
Table 5.2.2.4. Replacement Costs (Years 6 to 10)
Table 5.2.2.5. Replacement Costs (Years 11 to 15)
Table 5.2.2.6. Replacement Costs (Years 16 to 20)
Table 5.2.2.7. Present Value of Operations & Maintenance Costs (Years 1 – 10)
Table 5.2.2.8. Present Value of Operations & Maintenance Costs (Years 11 – 20)
Table 5.2.2.9. Present Value of Intermittent Operations & Maintenance Costs (Years 1 – 10)
Table 5.2.2.10. Present Value of Intermittent Operations & Maintenance Costs (Years 11 – 20)
Table 5.2.3. Total Present Worth for Feasible Alternatives
Section 6.0 Proposed Project Description
Section 6.1. Proposed Project Design Details
Table 6.1. Mechanical Bar Screen Design Criteria
Table 6.2. Shaftless Screw Conveyor Design Criteria
Table 6.3. Stacked Tray Grit Removal Design Criteria
Table 6.4. Grit Washing and Dewatering Equipment (Specific to GritCleanse) Design Criteria
Table 6.5. Grit Cyclone Design Criteria
Table 6.6. Grit Classifier Design Criteria
Table 6.7. Grit Pump Design Criteria
Table 6.8. Single Drop Design Criteria
Table 6.9. Influent Sampler Design Criteria
Table 6.10. Primary Clarifier Design Criteria
Table 6.11 Primary Sludge Pump Station Design Criteria
Table 6.12. Aeration Basin Design Criteria
Table 6.13. Aeration Blower Design Criteria
Table 6.14. Basin Requirements for 20 MGD and 24 MGD
Table 6.15. Secondary Clarifier Design Criteria
Table 6.16. Return Activated Sludge Pump Station Design Criteria
Table 6.17. Tertiary Filter Design Criteria
Table 6.18. UV Disinfection Facility Design Criteria
Table 6.19. UV Disinfection Facility Design – Reusing Equipment
Table 6.20. UV Disinfection Facility Design – All New Equipment
Table 6.21. Reclaimed Water Pump Station Design Criteria
Table 6.22. Drain Pump Station Design Criteria
Table 6.23. Thickening Equipment Design Criteria
Table 6.24. Thickening Polymer Design Criteria
Table 6.25. Dewatering Equipment Design Criteria
Table 6.26. Dewatering Polymer Design Criteria
Table 6.27. Conveyor Design Criteria
Table 6.28. Filtrate Pump Station Design Criteria
Table 6.29. Liquid Storage Design Criteria
Table 6.30. Design Criteria for Anaerobic Digester Tankage
Table 6.31. Digester Feed Pump Design Criteria
Table 6.32. Design Criteria for Digester Mixing Pumps
Table 6.33. Digestion HEX Design Criteria
Table 6.34. Boiler Design Criteria
Table 6.35. Primary Hot Water Recirculation Pump Design Criteria
Table 6.36. Secondary Hot Water Recirculation Pump Design Criteria
Table 6.37. Digested Sludge Heating Recirculation Pump Design Criteria
Table 6.38. Digested Sludge Transfer Pump Design Criteria
Table 6.39. Estimated Anaerobic Digestion System Gas Production at Various Influent Flows
Table 6.40. Digester Gas Production at Surge Rates
Table 6.41. Digester Gas Safety Equipment List
Table 6.42. Design Criteria for Waste Gas Burners
Table 6.43. Low Pressure Digester Gas Storage Design Criteria
Table 6.44. Digester Gas Conditioning Equipment Design Criteria
Table 6.45. Design Criteria for the Combined Heat and Power Equipment

Table 6.46. Septage Receiving Station Design Criteria
Table 6.47. Odor Control Design Criteria
Table 6.48. Odor Dispersion Fan Parameters
Table 6.49. Chemical Storage and Feed Facilities Design Criteria
Table 6.50. Estimated Electrical Load per Capacity Upgrade
Section 6.2. Proposed Project Design Details
Table 6.51. Biowin Effluent Characteristics
Section 7.0 Environmental Information Document
Table 7.1. Topography and Floodplains
Table 7.2. Soils
Table 7.3. Prime and Unique Farmland
Table 7.4. Land Use
Table 7.5. Forest Resources
Table 7.6.1. Wetlands and Streams
Table 7.6.2. Stream/Wetland Crossings
Table 7.7. Water Resources
Table 7.8. Wild and Scenic Rivers
Table 7.9. Coastal Resources
Table 7.10. Shellfish, Fish, and Their Habitats
Table 7.11. Wildlife and Natural Vegetation
Table 7.12. Public Lands and Scenic, Recreational, and State Natural Areas
Table 7.13. Areas of Archaeological or Historical Value
Table 7.14. Air Quality
Table 7.15. Noise Levels
Table 7.16 Introduction of Toxic Substances
Table 7.17. Environmental Justice Analysis
Table 7.18. Mitigative Measures
Section 8.0 Financial Analysis
Table 8.1 Applicant's/LGUs Financial Condition
Table 8.2 Funding Distribution
Table 8.3 Year 1 Interest and Repayment
Table 8.4 User Fee Increase Due to Project
Table 8.5 Impacts to User Rates
Table 8.6 Impact to Bills Due to Project
Section 9.0 Public Participation

Figures

Figure 1. Project Vicinity Map
Figure 2. Project Location Map
Figure 3. Existing Primary Clarifiers
Figure 4. Existing Primary Sludge Pump Station
Figure 5. Existing Trickling Filters
Figure 6. Existing Aeration Tank
Figure 7. Existing Intermediate Pump Station – Plan
Figure 8. Existing Intermediate Pump Station – Details
Figure 9. Existing Secondary Clarifiers
Figure 10. Existing Secondary Clarifiers – Details
Figure 11. Existing RAS Pump Station
Figure 12. Existing WAS Pump Station
Figure 13. Existing Recirculation Pump Station
Figure 14. Existing Gravity Belt Thickener
Figure 15. Existing TWAS Storage Tank
Figure 16. Existing Anaerobic Digesters
Figure 17. Existing Lime Stabilization System
Figure 18. Existing Filtrate Pump Station – Plan
Figure 19. Existing Filtrate Pump Station – Profile
Figure 20. Preferred Alternative Site Plan
Figure 21. BioDenipho with Thermal Sludge Drying Alternative – Site Plan
Figure 22. BioDenipho with Thermal Sludge Drying Alternative – Process Flow Diagram
Figure 23. Weekly Secondary Effluent UVT (Oct 2019 – Oct 2023)
Figure 24. Collimated Beam Test Results (April 5, 2024)
Figure 25. Particle Size Analysis Results
Figure 26. Digester Volume Allocations
Figure 27. Concentration Dispersion w/o Fan
Figure 28. Concentration Dispersion w/ Fan
Figure 29. Topography Map
Figure 30. Floodplain Map
Figure 31. Prime and Unique Farmland Map
Figure 32. City of Wilmington Zoning Map
Figure 33. CAMA Land Use Map
Figure 34. Biodiversity Wildlife Assessment Map
Figure 35. LMG Cape Fear River Channel Map – Plan View with Aerial
Figure 36. LMG Cape Fear River Channel Map – Detail
Figure 37. Wetlands and Streams Map
Figure 38. AU 18-(71)a3 Map
Figure 39. AU 18-(71)a4 Map
Figure 40. AU 18-(71)a5 Map
Figure 41. Primary Nursery Area Designation Map
Figure 42. Fish Nursery Areas Map
Figure 43. Anadromous Fish Spawning Areas Map
Figure 44. NC Natural Heritage Program Managed Areas
Figure 45. NC Natural Areas
Figure 46. Public Parks Map
Figure. 47 Historic Sites Map

Appendices

Appendix A. CFPUA Sewer Collection System Map
Appendix B. CFPUA 2022-2023 Wastewater System Performance Report
Appendix C. Existing CFPUA SSWWTP Process Flow Diagram & Site Plan
Appendix D. NPDES Permit No. NC0023973
Appendix E. New Hanover County 2022 Census Data
Appendix F. SSWWTP Flow Data (2020 – 2023)
Appendix G. CFPUA Capital Improvements Plan (Fiscal Years 2023 – 2032)
Appendix H. New Hanover County 2023-2050 Population Projection by Age
Appendix I. City of Wilmington Land Development Code – Article 13. Floodplain Management
Appendix J. Soil Survey Report
Appendix K. Soil and Groundwater Sampling Report Southside WWTP Expansion Wilmington Police Department Firing Range
Appendix L. City of Wilmington Code of Ordinances – Article 2. Zoning Districts
Appendix M. City of Wilmington Code of Ordinances – Article 8. Landscaping and Tree Preservation
Appendix N. City of Wilmington Tree Removal Permit
Appendix O. New Hanover County Unified Development Ordinance – Article 8. Erosion and Sedimentation Control
Appendix P. Aquifer Maps
Appendix Q. Excerpt from 2022 North Carolina 303(d) List
Appendix R. CAMA Consistency Review Correspondence
Appendix S. Correspondence Related to Missing USFWS Comments
Appendix T. NC Department of Natural and Cultural Resources Report
Appendix U. NC Department of Natural and Cultural Resources Exemption Letter
Appendix V. Memorandum of Agreement – NCDEQ and NCSHPO for SSWWTP
Appendix W. NCDEQ Practice Standards and Specifications – Dust Control
Appendix X. City of Wilmington General Ordinances – Chapter 6. Article II. Noise Control
Appendix Y. EJScreen Community Report
Appendix Z. CFPUA FY 2024 Rates and Fees Schedule
Appendix AA. Response to NCDEQ Comments (dated 04/23/2024)
Appendix BB. Response to NCDEQ Comments (dated 08/16/2024)

Section 1.0 Executive Summary

The Cape Fear Public Utility Authority (CFPUA) operates a comprehensive wastewater collection, conveyance, and treatment system in New Hanover County. M'Kean Maffitt Wastewater Treatment Plant (Southside WWTP) is one of two major treatment centers operated by CFPUA. The Southside WWTP (SSWWTP) was originally constructed in 1971 as a 6 MGD trickling filter plant. In 1986, the plant was substantially expanded to 12 MGD and included the addition of a short detention activated sludge process for improved treatment by repurposing the original secondary clarifier. The existing treatment process includes:

- Primary screening and settling
- Secondary trickling filtration and activated sludge treatment
- UV disinfection
- Anaerobic digestion and dewatering

New Hanover County has experienced increased growth and development over the past decade. By 2044, the average daily flow generated in the SSWWTP service area is projected to be 13.575 MGD, which is approximately 113% of the facility's existing 12 MGD permitted capacity and approximately 84.85% of the facility's proposed 16 MGD expanded capacity.

The following six alternatives were investigated:

- No action
- Densification with anaerobic sludge digestion (preferred alternative)
- Optimum operations of existing facilities
- Decentralized systems
- Regionalization
- BioDenipho with thermal sludge drying

The no action alternative was deemed infeasible because it wouldn't meet public needs or prepare for anticipated growth, leaving the SSWWTP vulnerable to failures and environmental harm. Optimum operation of existing facilities was deemed infeasible because it does not address the facility's inability to treat projected flows. Decentralization was deemed infeasible because construction of individual and/or clustered treatment systems would be extremely expensive and require extensive permitting, construction coordination, and routine maintenance. Regionalization was deemed infeasible because there are no municipal wastewater treatment facilities with sufficient treatment capacity within a 10-mile radius of the SSWTP. Lastly, BioDenipho with thermal sludge drying was rejected because it would require more space, and thus be more expensive, than the preferred alternative.

The preferred alternative involves replacing and expanding the wastewater treatment plant to meet future needs, making it the best alternative. It will enhance treatment capabilities, increase capacity, and improve overall performance, preparing the Authority for anticipated growth. Environmental impacts will be minor and temporary during construction, with measures in place to mitigate negative impacts. The preferred alternative aligns with project goals, remains financially viable, and minimizes environmental consequences, making it the most feasible alternative.

The proposed Southside Wastewater Treatment Plant Replacement and Capacity Upgrade project will replace and expand the existing CFPUA SSWWTP from 12 MGD to 16 MGD with provisions to expand to 20 MGD and 24 MGD in the future. This project will include a completely new treatment process, and most existing facilities will be replaced or repurposed. The proposed facilities include:

- Screenings and grit removal facility with flow measurement
- Primary clarifiers and primary sludge pumping
- Aeration basins and blower building
- Secondary clarifiers and return and waste activated sludge pumping
- Tertiary filters
- Ultraviolet disinfection facility
- Outfall
- Reclaimed water pump station
- Drain pump station
- Thickening and dewatering equipment and building
- Filtrate pump station
- Liquid sludge storage tanks
- Anaerobic digesters and digester control building
- Digester gas handling and utilization facilities
- Modifications to the existing cake storage with offsite cake solids receiving
- Septage/Vactor truck receiving station
- Odor control facilities
- Chemical storage and feed facilities
- Administration building with observation deck and laboratory
- Generators
- SCADA network

A project vicinity map is included in Figure 1, while a project location map is included in Figure 2.

The wastewater treatment plant expansion and rehabilitation project will allow for additional growth in New Hanover County, modernize the treatment processes, replace units that are more than 20 years old, and improve the quality of the treated effluent being released into the Cape Fear River.

The project is anticipated to have minimal environmental impacts due to construction activities. The environmental impacts associated with the project will include minor, temporary, direct construction impacts to soil, topography, noise, and air as construction takes place. Mitigation is proposed to minimize these impacts, including minimizing the construction area to the greatest extent practical, utilizing silt fences to keep sedimentation onsite, restricting construction to weekdays during daylight hours, and reducing dust.

An expanded WWTP could support additional population growth and development which could negatively affect the environmental features discussed in Section 7.0. It is anticipated that existing permitting requirements, laws, and ordinances will mitigate potential impacts caused by such growth. It should be noted that in 2013, an Environmental Assessment was prepared per the State Environmental Protection Act (SEPA) guidelines for an expansion of the WWTP to 24 MGD. A Finding of No Significant Impact (FONSI) was issued in September 2013, and the permit to expand the facility up to 24 MGD was issued. Secondary and cumulative impacts were addressed as part of this assessment, and it was determined that expansion of the facility would not result in significant impacts to the environment. Subsequently, the facility was issued an NPDES permit for phased expansions to 16 MGD, 20 MGD, and 24 MGD.

The total cost of the project is $246,767,584. The sources of funding include the Clean Water State Revolving Fund, capital reserves, and revenue bonds in the amount of $70,000,000, $48,407,514, and $126,960,070, respectively. The proposed project will have minimal impacts to user fees and will increase the water and sewer bill to 1.93% of the MHI.

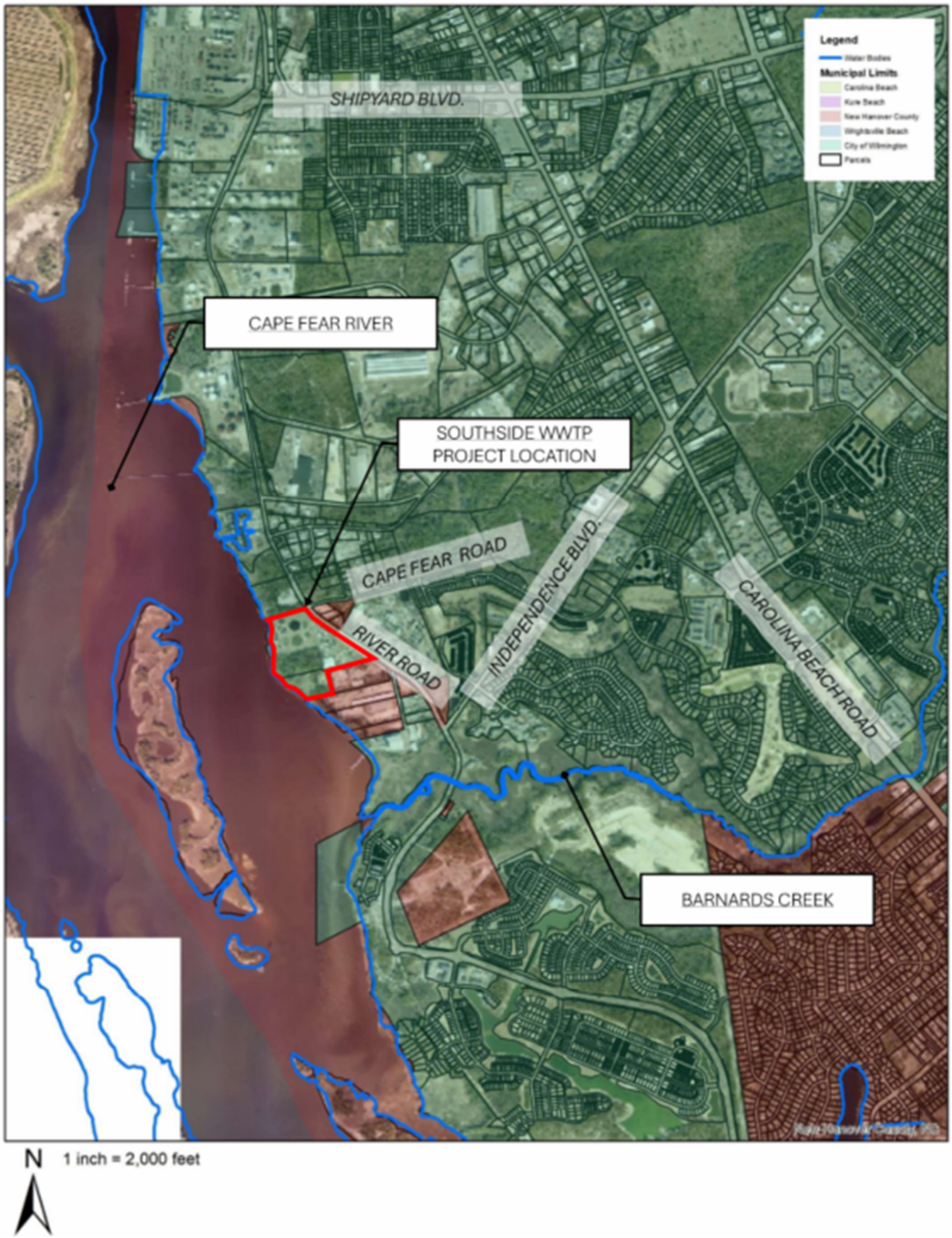


Figure 1. Project Vicinity Map



Figure 2. Project Location Map

Section 2.0 Current Situation

Table 2.1. Overview of Collection System **Southside WWTP Replacement & Capacity Upgrade Project** **Cape Fear Public Utility Authority**	
Provide information related to the Collection System and related issues (I/I, SSOs) in accordance with Section 3.3.1 of the guidance.	
Figure Number for Collection System map:	Appendix A
For use with programs funded or co-funded with the CWSRF, WW-SRP, WW-SEL, and CDBG-I programs.	
Supporting information appendix reference:	Appendix B
Complete this table in accordance with Subchapter 2.2.1 of Part B of the guidance.	
According to the CFPUA 2022-2023 Wastewater System Performance Report, CFPUA sewer collection system includes 158 pump stations and over 1,100 miles of sewer mains. Although I&I contributes to periods of high flow, the SSWWTP needs to be expanded to accommodate increased growth and development. This project is not related to SSOs.	

Table 2.2. General WWTP Condition

Southside WWTP Replacement & Capacity Upgrade Project

Cape Fear Public Utility Authority

For use with projects funded or co-funded with the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.

Plan and schematic appendix reference:	Appendix C
Supporting information appendix reference:	N/A

Provide a brief description of the WWTP condition as discussed in Subchapter 2.2.2.1 of Part B of the guidance.

The SSWWTP was originally constructed in 1971 as a 6 MGD trickling filter plant before expanding to 12 MGD in 1986. The existing wastewater treatment system includes primary screening and clarification, trickling filtration, aeration, secondary clarification, UV disinfection, sludge thickening, and anaerobic digestion.

CFPUA operations staff annually identifies infrastructure of greatest concern from a condition, functionality, and age perspective. Based on this information, engineering staff conduct site visits to prioritize capital improvements. Several assets have been rated as fair, poor, or decommissioned. Some major elements of the existing WWTP are greater than 20-years old and require replacement and/or expansion.

The wastewater flow in southern New Hanover County has been steadily increasing and is quickly approaching the SSWWTP's permitted capacity under peak conditions. Historically, CFPUA has redirected wastewater flow from the SSWWTP to the NSWWTP on an as-need basis; however, the NSWWTP needs its entire treatment capacity to handle flow from increased growth and development throughout the northern region of the county.

By 2044, the average daily flow generated in the SSWWTP service area is projected to be 13.575 MGD, which is approximately 113% of the facility's existing 12 MGD permitted capacity and approximately 84.85% of the facility's proposed 16 MGD expanded capacity. Expanding the capacity of SSWWTP will restore capacity at NSWWTP and provide CFPUA with the ability to meet wastewater treatment and disposal needs in the service area of the SSWWTP.

NPDES or Non-Discharge Permit No.	Permit No NC0023973
WWTP Permitted Flow (MGD):	12.00
Appendix Reference for permit:	Appendix D

Provide information related to any NOVs the WWTP may have received or any special orders that may be in place.

NOVs	Special Orders
Does the WWTP have any NOVs? ☐ Yes ☒ No ☐ N/A (new construction only)	Does the WWTP have any Special Orders or pending SOCs? ☐ Yes, Special Order is finalized ☐ Yes, Special Order is pending ☒ No
If yes, then describe and provide supporting information in an appendix of the ER/EID.	*If yes, then describe and provide supporting information in an appendix of the ER/EID.*
Appendix Reference: N/A	Appendix Reference: N/A
N/A	N/A

Table 2.3.1. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Bar Screens					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	N/A	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good ☒ Fair ☐ Poor ☐ N/A	28	4 ft channel width 3/8-inch clear opening between bars 2 ft screenings conveyor width

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
The two mechanical bar screens, each with a grit removal and storage unit, were installed in 1996. Bar screen conveyor with 1 HP Thumper motor. Screenings and grit are conveyed to solid waste containers and removed by trucks for landfill disposal. Two backup manual bar screens present, each with ¾-inch clear openings between bars and a 4 ft wide channel. Two Detritor grit collectors, each with 5 MGD average capacity and 14 ft diameter. Two reciprocating rake grit classifiers.

Table 2.3.2. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Primary Clarifiers					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 3	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good ☒ Fair ☐ Poor ☐ N/A	Primary clarifier #1 – 38 Primary clarifier #2 – 8	100 ft diameter, each 12 ft SWD, each 7,854 ft^2 surface area, each 0.70 MG, each

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
Dual circular center feed primary clarifiers. Primary clarifier #1 was installed in 1986. Primary clarifier #2 was installed in 2016. Each equipped with scum beach collector. Two submersible primary scum pumps.

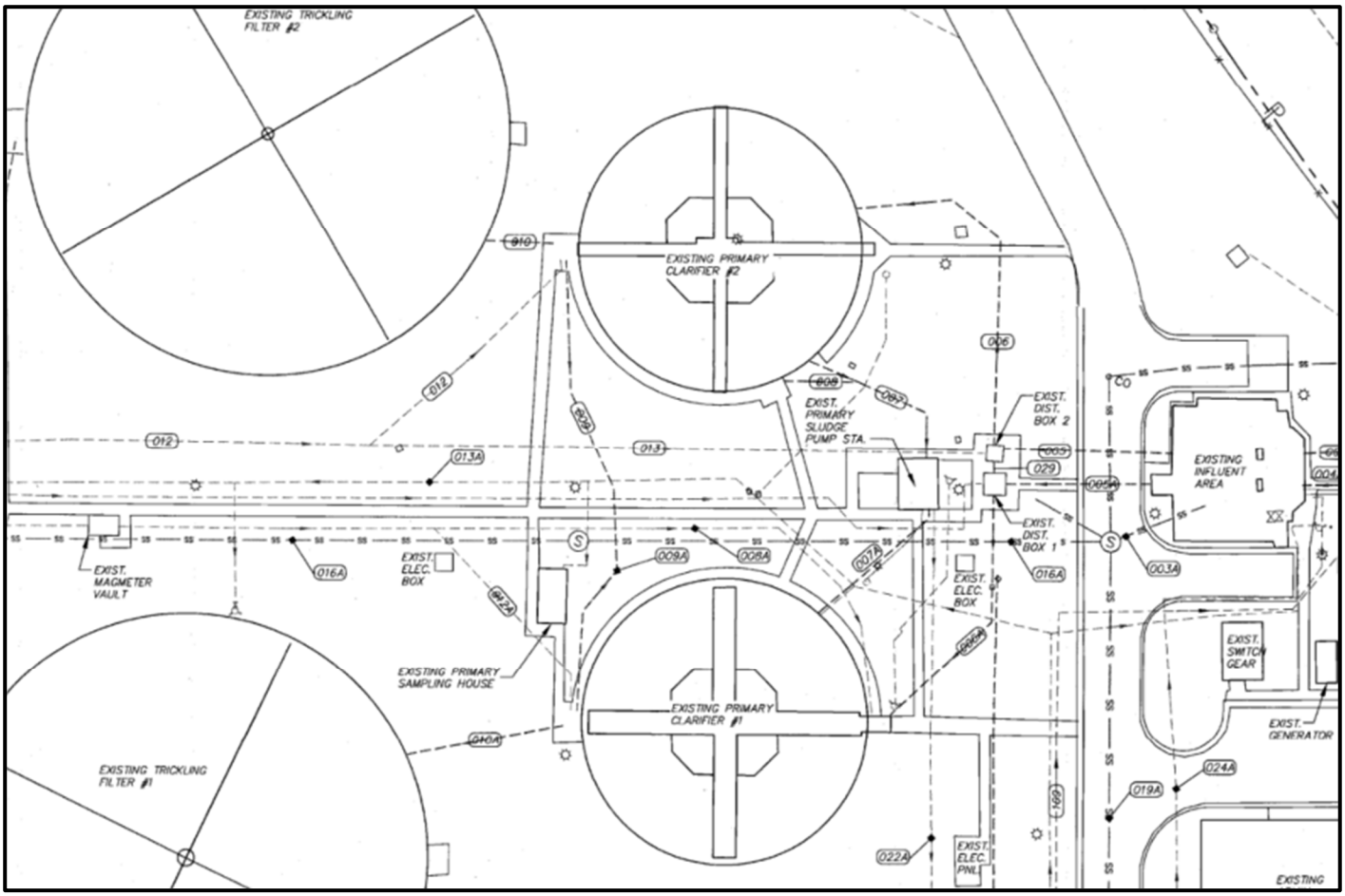


Figure 3. Existing Primary Clarifiers

Table 2.3.3. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Primary Sludge Pump Station					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 4	Additional Information Reference:	N/A

Condition	Age	Size
☐ Good ☒ Fair ☐ Poor ☐ N/A	Pump #1 – 7 Pump #2 – 7 Pump #3 – 7	200 gpm at 70 ft TDH

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
Three (3) disc sludge pumps, each with a 10 hp motor. Pump #1 was installed in November 2017, Pump #2 was installed in April 2017, and Pump #3 was installed in September 2017.

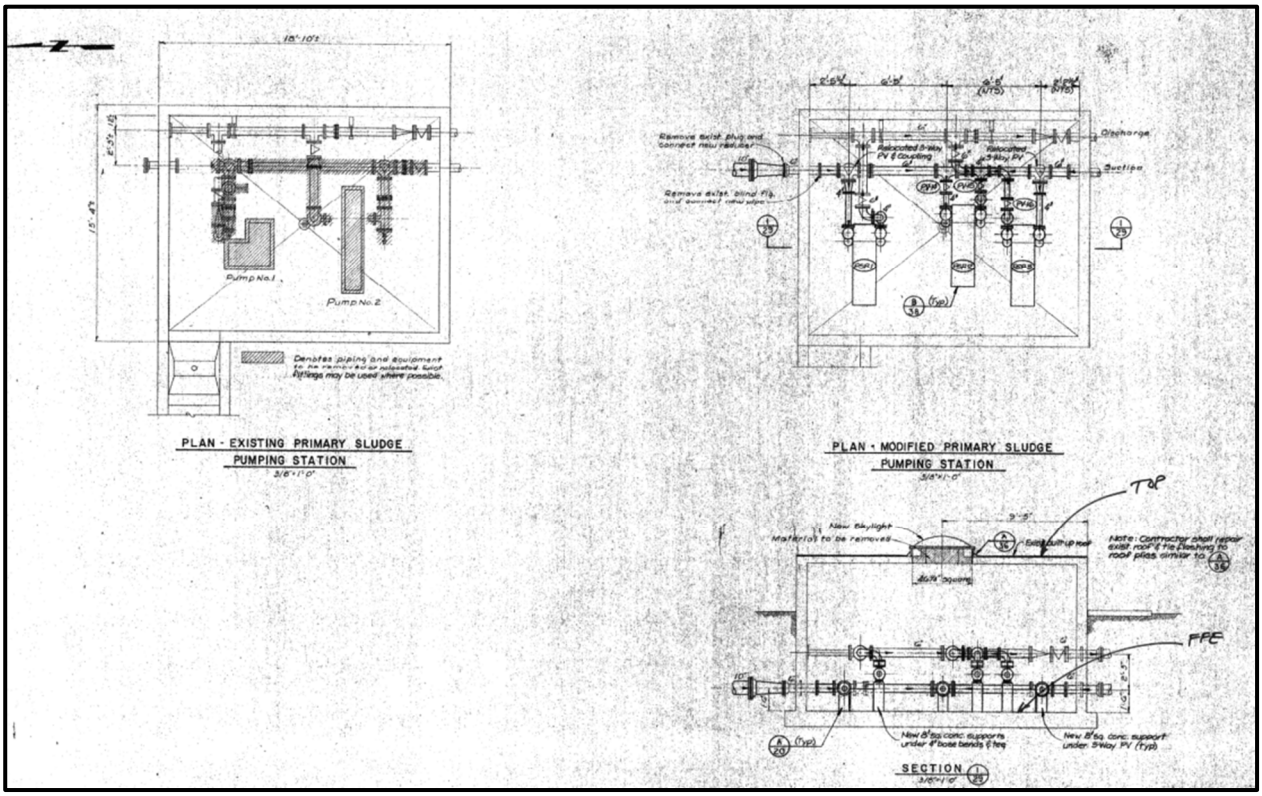


Figure 4. Existing Primary Sludge Pump Station

Table 2.3.4. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Trickling Filters					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 5	Additional Information Reference:	N/A

Condition	Age	Size
☐ Good ☒ Fair ☐ Poor ☐ N/A	Trickling filter #1 – 53 Trickling filter #2 – 38	180-ft diameter, each 5.25 ft depth of media 25,450 ft^2 surface area, each

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
Dual trickling filters. Trickling filter #1 contains rock media and was installed in 1971. Trickling filter #2 contains plastic media and was installed in 1986. One recirculating pump station is equipped with three 40 HP vertical turbine pumps in fair condition.

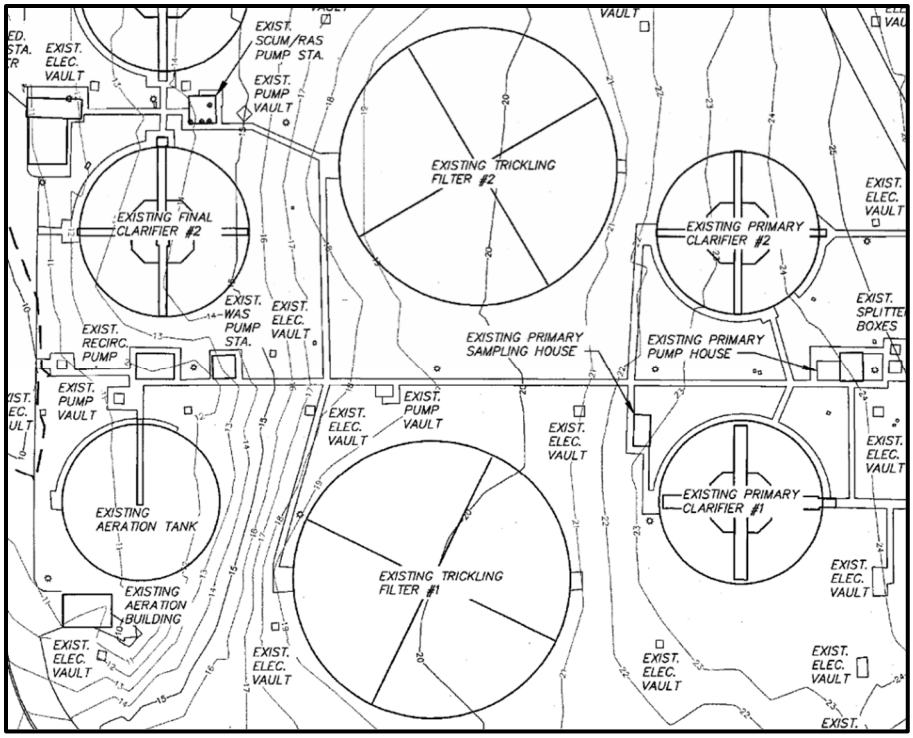


Figure 5. Existing Trickling Filters

Table 2.3.5. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Aeration Tank					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 6	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good ☒ Fair ☐ Poor ☐ N/A	Aeration Tank – 53 Blower No. 1 – 38 Blower No. 2 – 38 Blower No. 3 – 38	95-ft diameter 10-ft depth 0.53 MG

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
One aeration tank equipped with three 100 HP multi-stage centrifugal blowers (installed in 1986) and 216 course bubble diffusers. Blower motor no. 1 was replaced in 2016. The aeration tank was converted from a secondary clarifier in 1986; however, the original secondary clarifier structure was constructed in 1971. Equipped with HACH SC200 dissolved oxygen meter that was installed in November 2020 and is in good condition.

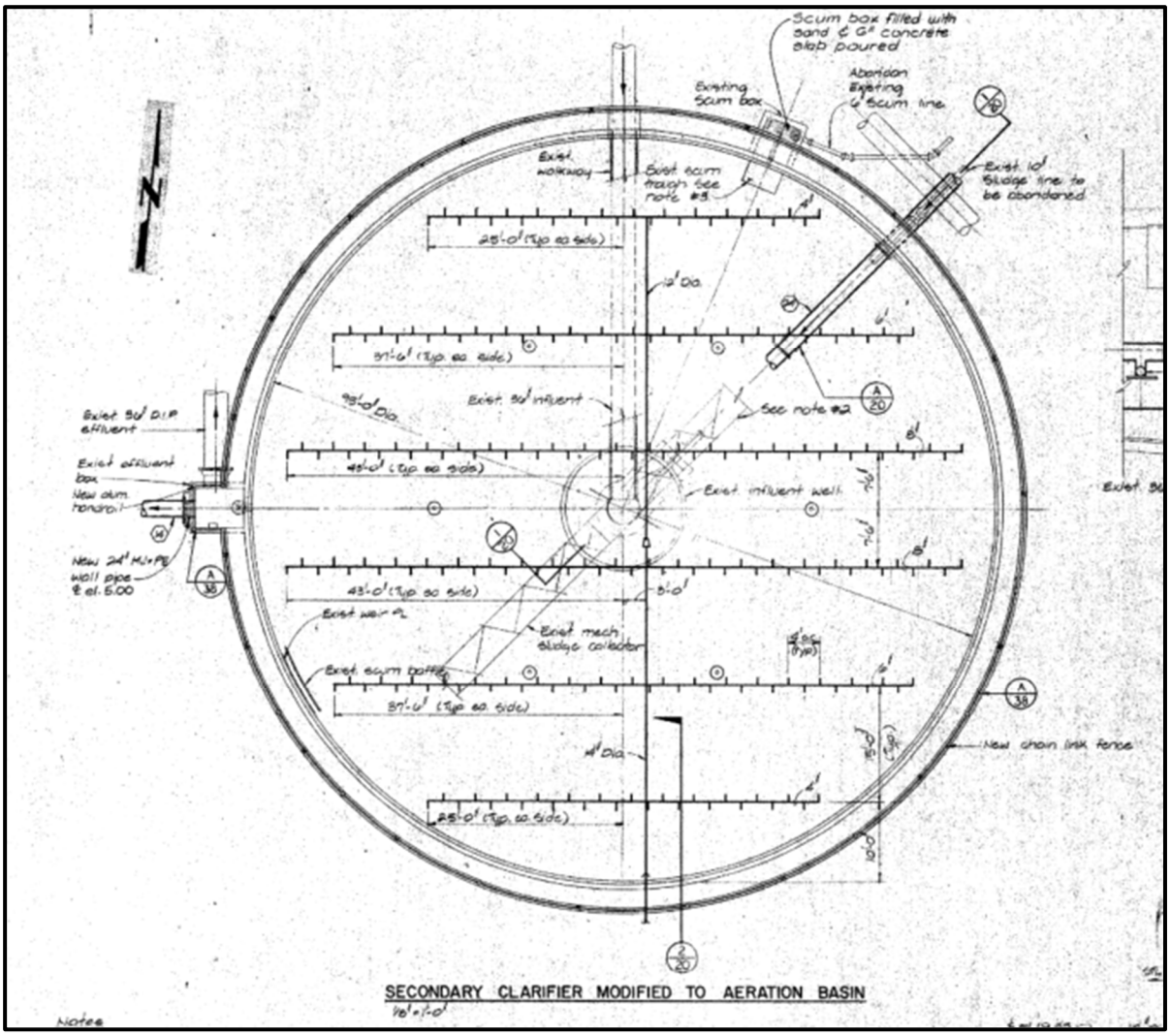


Figure 6. Existing Aeration Tank

Table 2.3.6. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Intermediate Pump Station					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 7 & Figure 8	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good ☒ Fair ☐ Poor ☐ N/A	Intermediate Pump Station – 38 Screw Pump No. 1 – unknown Screw Pump No. 2 – unknown Screw Pump No. 3 – unknown	10,400 gpm 11.46 ft lift 50 HP, each

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
One intermediate pump station installed in 1986 expansion. Three 50 HP screw pump motors (two installed July 2015 in fair condition; one installed August 2022 in good condition). One 200 kW standby generator installed August 2019 in good condition.

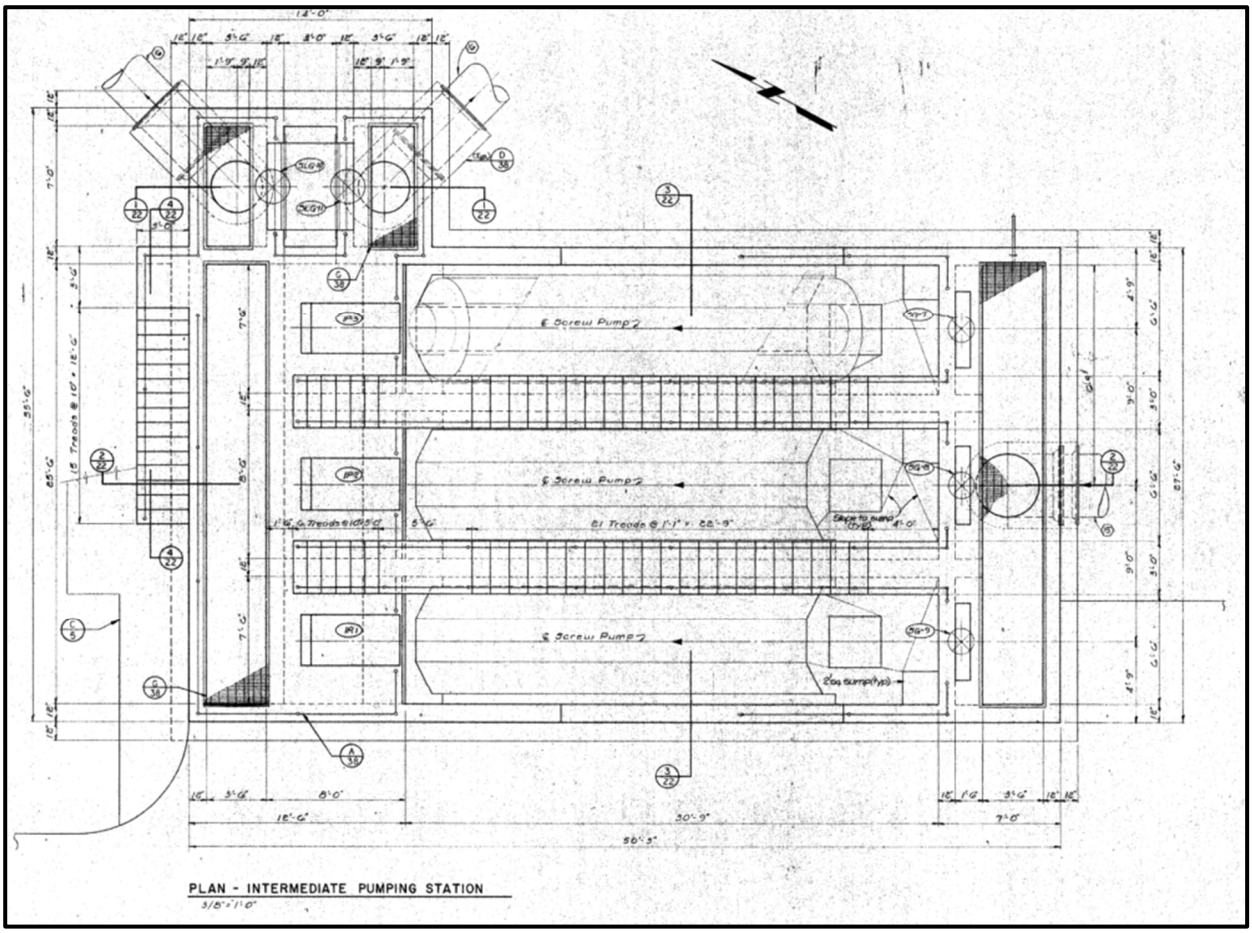


Figure 7. Existing Intermediate Pump Station - Plan

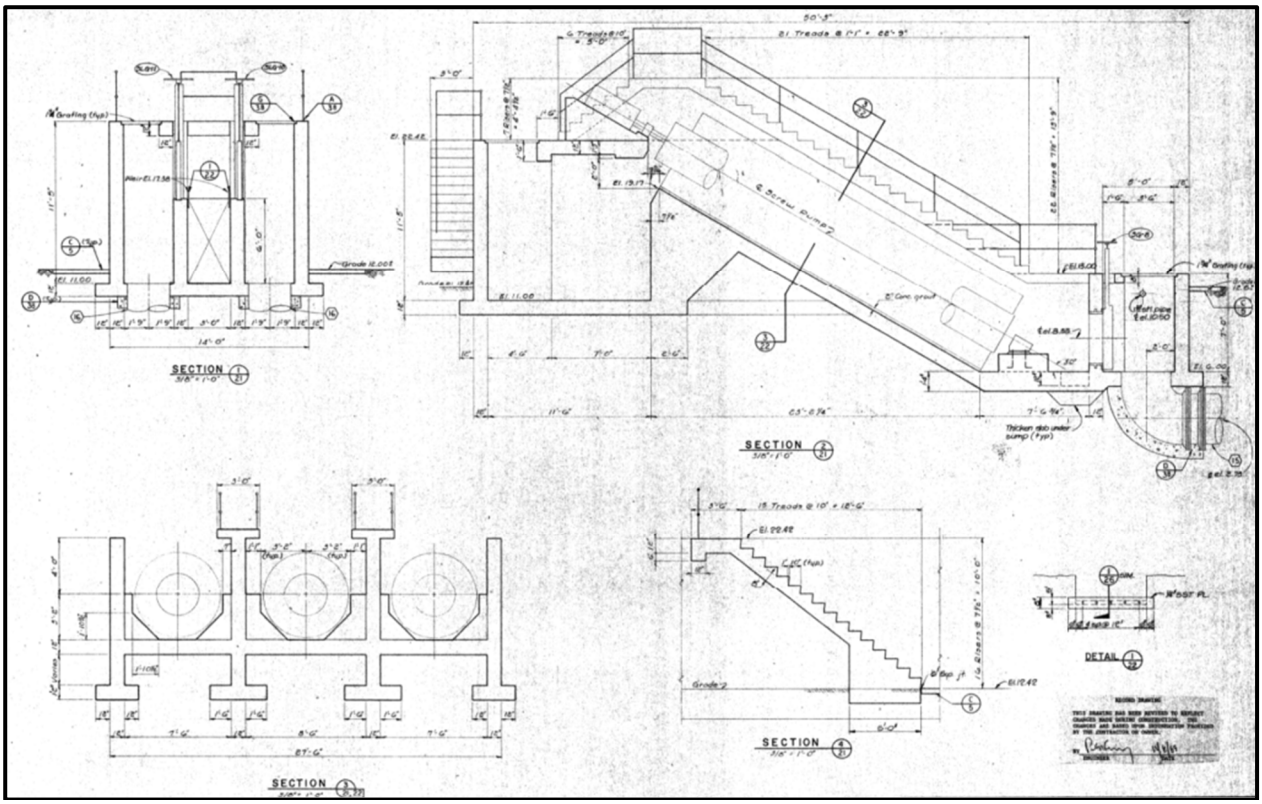


Figure 8. Existing Intermediate Pump Station - Details

Table 2.3.7. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Secondary Clarifiers					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 9 & Figure 10	Additional Information Reference:	N/A

Condition	Age	Size
☐ Good ☒ Fair ☐ Poor ☐ N/A	Secondary clarifier #1 – 38 Secondary clarifier #2 – 38	105 ft diameter, each 14 ft SWD, each 8,660 ft^2 surface area, each 1.8 MG total volume

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
Dual circular center feed secondary clarifiers were installed in 1986. Equipped with scraper solids removal system, rotating scum pipe, and ducking skimmer. Dual 75 gpm, 5 HP plunger scum pumps.

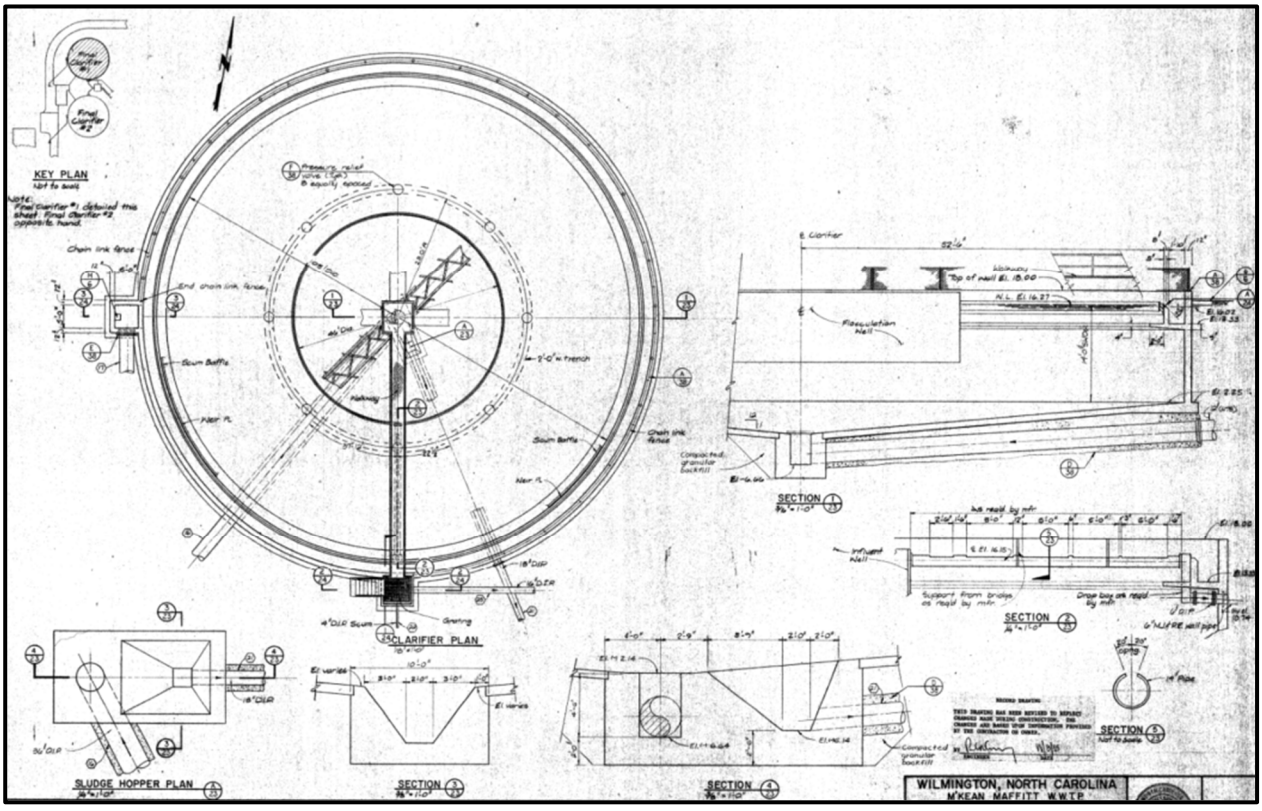


Figure 9. Existing Secondary Clarifiers

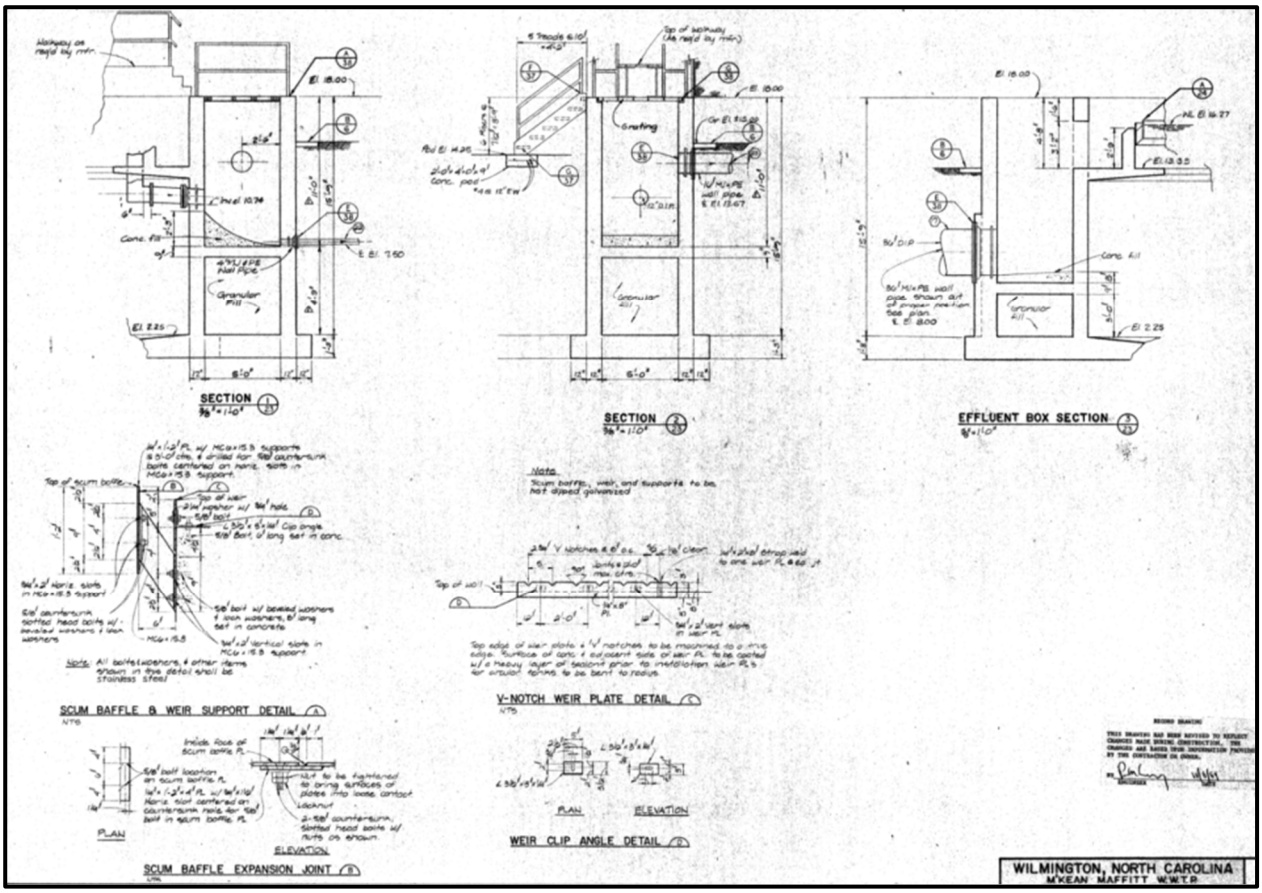


Figure 10. Secondary Clarifiers - Details

Table 2.3.8. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
RAS Pump Station					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 11	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good ☒ Fair ☐ Poor ☐ N/A	RAS Pump Station – 38 Pump No. 1 – unknown Pump No. 2 – unknown	Unknown

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
One return activated sludge pump station installed in 1986 expansion. Station equipped with two pumps.

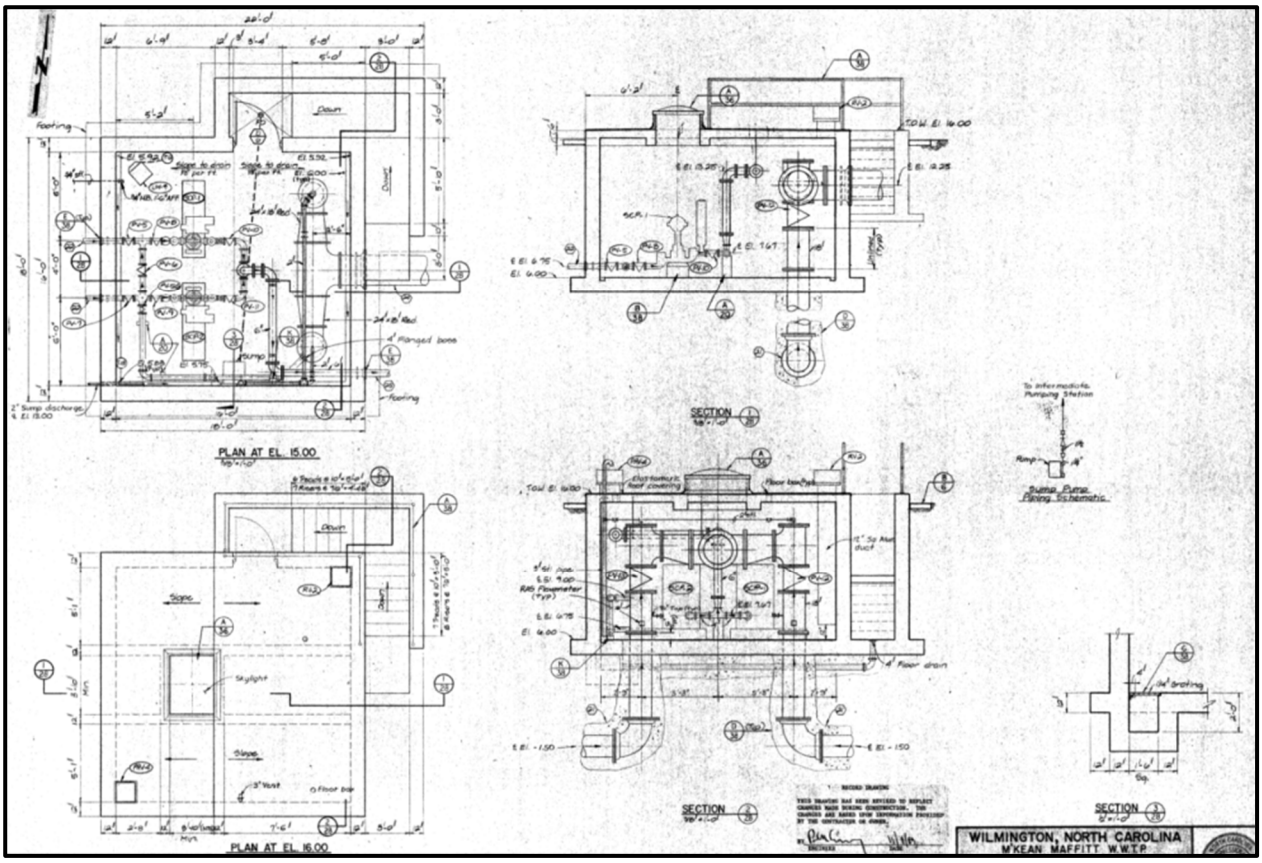


Figure 11. Existing RAS Pump Station

Table 2.3.9. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
WAS Pump Station					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 12	Additional Information Reference:	N/A

Condition	Age	Size
☐ Good ☒ Fair ☐ Poor ☐ N/A	WAS Pump Station – 54 Pump No. 1 – 38 Pump No. 2 – 38 Pump No. 3 – 38	Pump No. 1 – 230 gpm at 55 ft TDH, 7.5 HP Pump No. 2 – 230 gpm at 55 ft TDH, 7.5 HP Pump No. 3 – 200 gpm at 70 ft TDH, 15 HP

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
One waste activated sludge pump station installed in 1970. Later renovated in 1986 expansion. Station equipped with three centrifugal pumps.

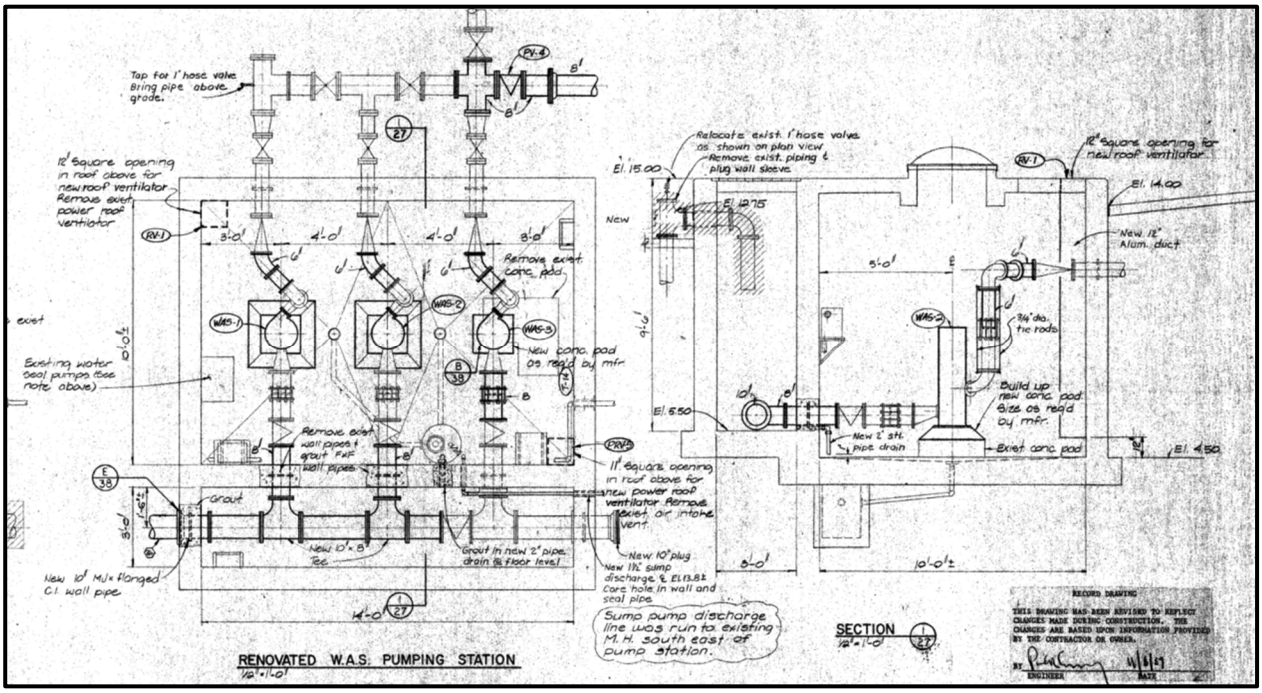


Figure 12. Existing WAS Pump Station

Table 2.3.10. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Recirculation Pump Station					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 13	Additional Information Reference:	N/A

Condition	Age	Size
☐ Good ☒ Fair ☐ Poor ☐ N/A	Recirculation PS – 54 Pump No. 1 – 38 Pump No. 2 – 38 Pump No. 3 – 38	Pump No. 1 – 4,200 gpm at 21 ft TDH, 40 HP Pump No. 2 – 4,200 gpm at 16 ft TDH, 30 HP Pump No. 3 – 4,200 gpm at 16 ft TDH, 30 HP

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
One recirculation pump station was installed in 1970. Later renovated in 1986 expansion. The station is equipped with three vertical turbine pumps.

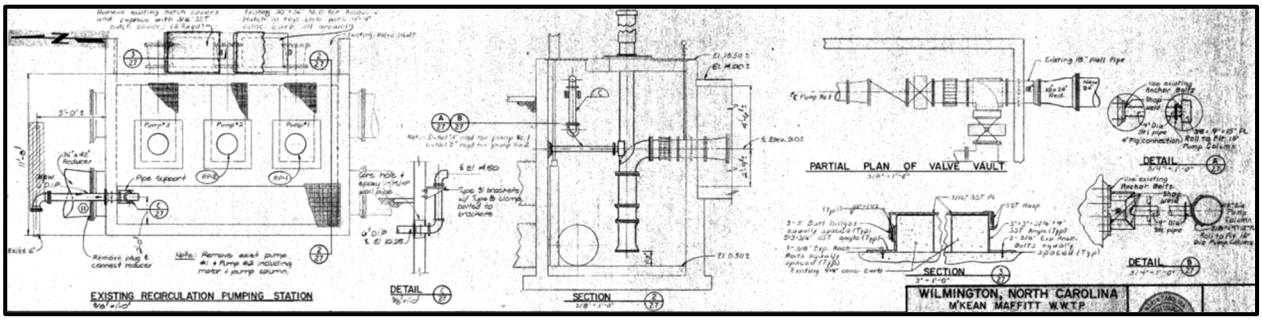


Figure 13. Existing Recirculation Pump Station

Table 2.3.11. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
UV Disinfection					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	N/A	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☒ Good ☐ Fair ☐ Poor ☐ N/A	UV Disinfection Chamber – 54 UV Disinfection Equipment – 4	Chamber 50 ft length, each 55 ft width, each 452,000-gallon total volume

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
The disinfection chamber was originally installed as a chlorine contact chamber in 1970 and later converted to dual UV disinfection chambers in 2020. Each chamber is equipped with four banks. Each bank is equipped with 24 lamps.

Table 2.3.12. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Discharge Piping					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	N/A	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good ☒ Fair ☐ Poor ☐ N/A	36-inch pipe – 54 42-inch pipe – 38	36-inch diameter & 42-inch diameter

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
36-inch RCP piping from chlorine contact chamber to effluent weir box. 42-inch piping from effluent weir box to discharge point.

Table 2.3.13. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Gravity Belt Thickeners					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 14	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good ☒ Fair ☐ Poor ☐ N/A	31	2.0 meters, each

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
Two gravity belt thickeners were installed in 1993 as part of the solids processing facilities improvements project. The gravity belt thickener polymer system consists of two 750-gallon tanks and two metering pumps. Two 170 gpm, 80 ft TDH, 5 HP diaphragm pumps transfer thickened WAS to TWAS storage tank.

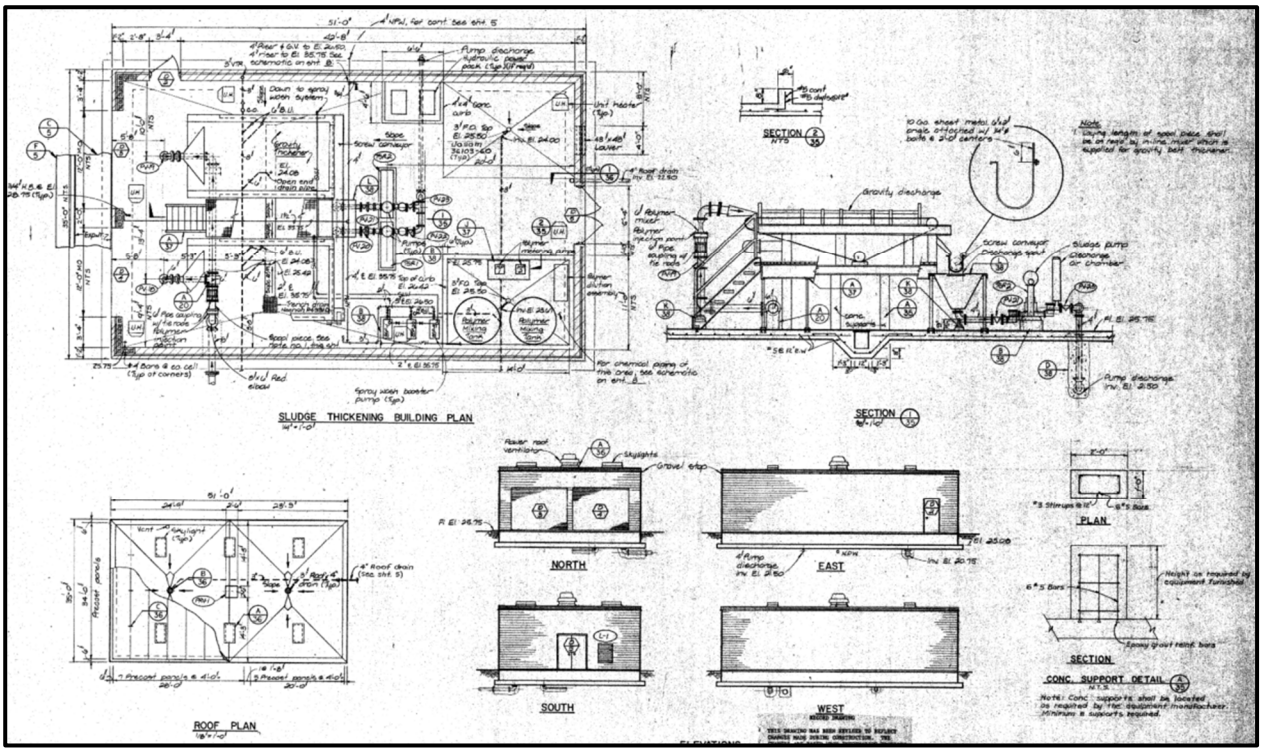


Figure 14. Existing Gravity Belt Thickeners

Table 2.3.14. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
TWAS Storage Tank					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 15	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good ☒ Fair ☐ Poor ☐ N/A	31	32,000 gallons 17.5 ft length 17.5 ft width 14 ft SWD

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
One 32,000-gallon TWAS sludge storage tank was installed in 1993 as a part of the solids processing facilities improvements project. Equipped with a 5 HP mixer and two 50 gpm, 15 ft TDH, 3 HP progressive cavity WAS sludge transfer pumps.

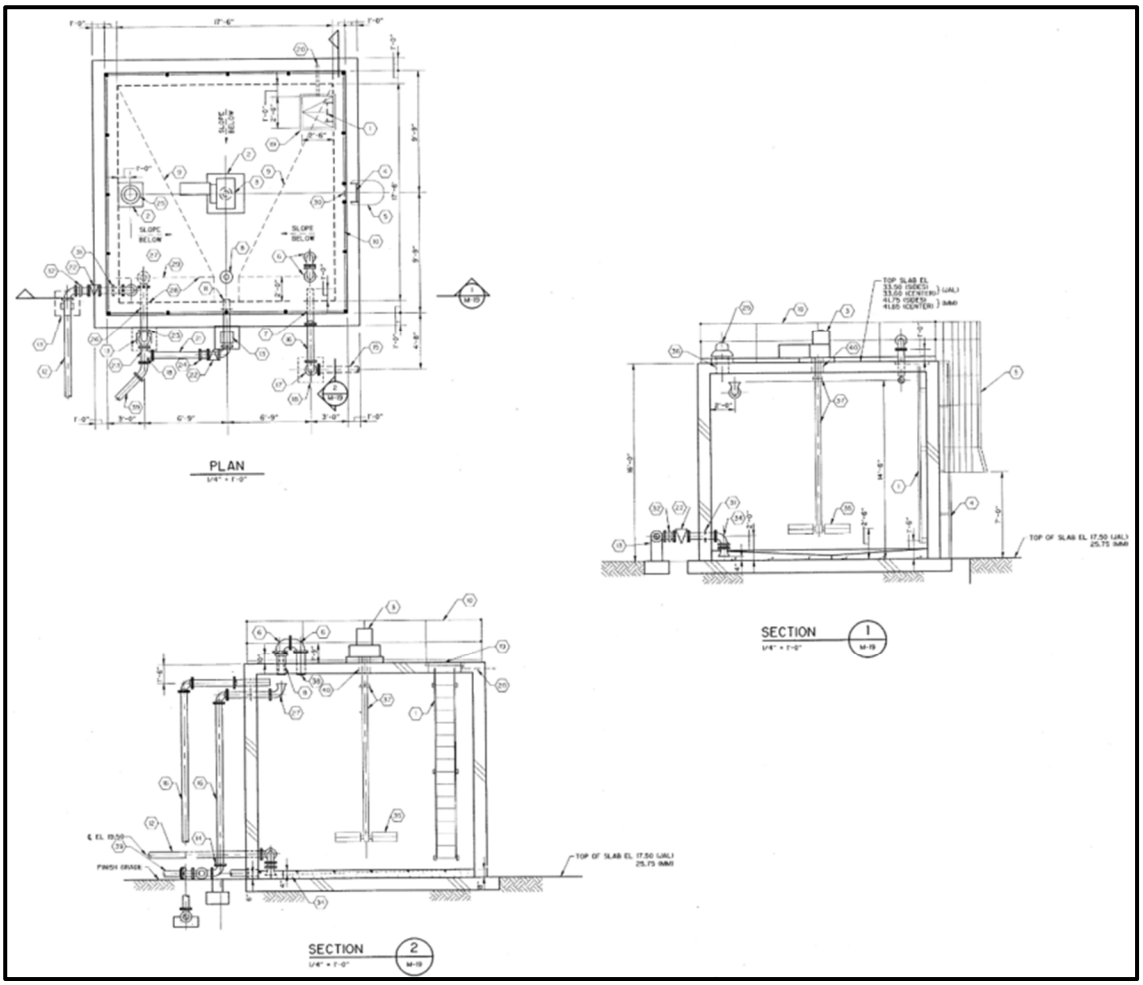


Figure 15. Existing TWAS Storage Tank

Table 2.3.15. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Anaerobic Digesters					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 16	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good	Digester No. 1 – 38	Digester No. 1 – 60 ft diameter, 18 ft SWD, 0.381 MG
☒ Fair	Digester No. 2 – 54	Digester No. 2 – 60 ft diameter, 18 ft SWD, 0.381 MG
☐ Poor	Digester No. 3 – 54	Digester No. 3 – 60 ft diameter, 18 ft SWD, 0.381 MG
☐ N/A	Digester No. 4 – 54	Digester No. 4 – 85 ft diameter, 25 ft SWD, 1.06 MG

Additional Information

Provide any additional information that may be helpful in describing the equipment discussed above.

Digester No. 4 equipped with seven Cannons mixers. Digester No. 2 is not equipped with a mixing system, but it is equipped with a gas holding cover. Digester No. 1 and 3 equipped with six Cannons mixers each.

Two 150 gpm, 46 ft TDH, 15 HP horizontal non-clog recirculation pumps. One 360 gpm, 26 ft TDH, 10 HP horizontal recessed impeller recirculation pumps. One 700 gpm, 15 HP centrifugal digester transfer pump.

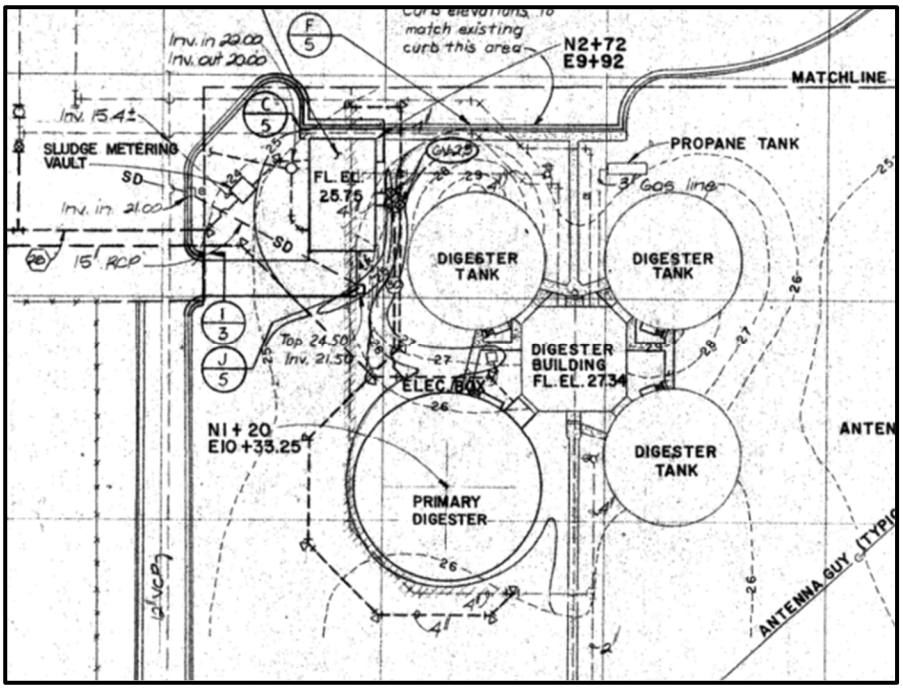


Figure 16. Existing Anaerobic Digesters

Table 2.3.16. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Belt Filter Press					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	N/A	Additional Information Reference:	N/A
Condition		**Age**		**Size**	
☐ Good ☒ Fair ☐ Poor ☐ N/A		31		2.0 meters, each	
Additional Information					
Provide any additional information that may be helpful in describing the equipment discussed above.					
Two belt filter presses installed in 1993 solids processing facilities improvements project. Three 200 gpm, 45 ft TDH progressive cavity belt filter press feed pumps. The polymer system consists of 2 mixing tanks and 4 storage tanks.					

Table 2.3.17. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Lime Stabilization System					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 17	Additional Information Reference:	N/A

Condition	**Age**	**Size**
☐ Good ☒ Fair ☐ Poor ☐ N/A	31	N/A

Additional Information
Provide any additional information that may be helpful in describing the equipment discussed above.
Sludge drying beds were installed in 1970 and later converted to the existing lime stabilization system in the 1993 solids processing facilities improvements project. Major system components include air compressor, lime silo, belt conveyor, screw conveyor, ventilation system, and lime sludge bins. Sludge stored on 1.05-acre pad, of which 0.61 acres are covered.

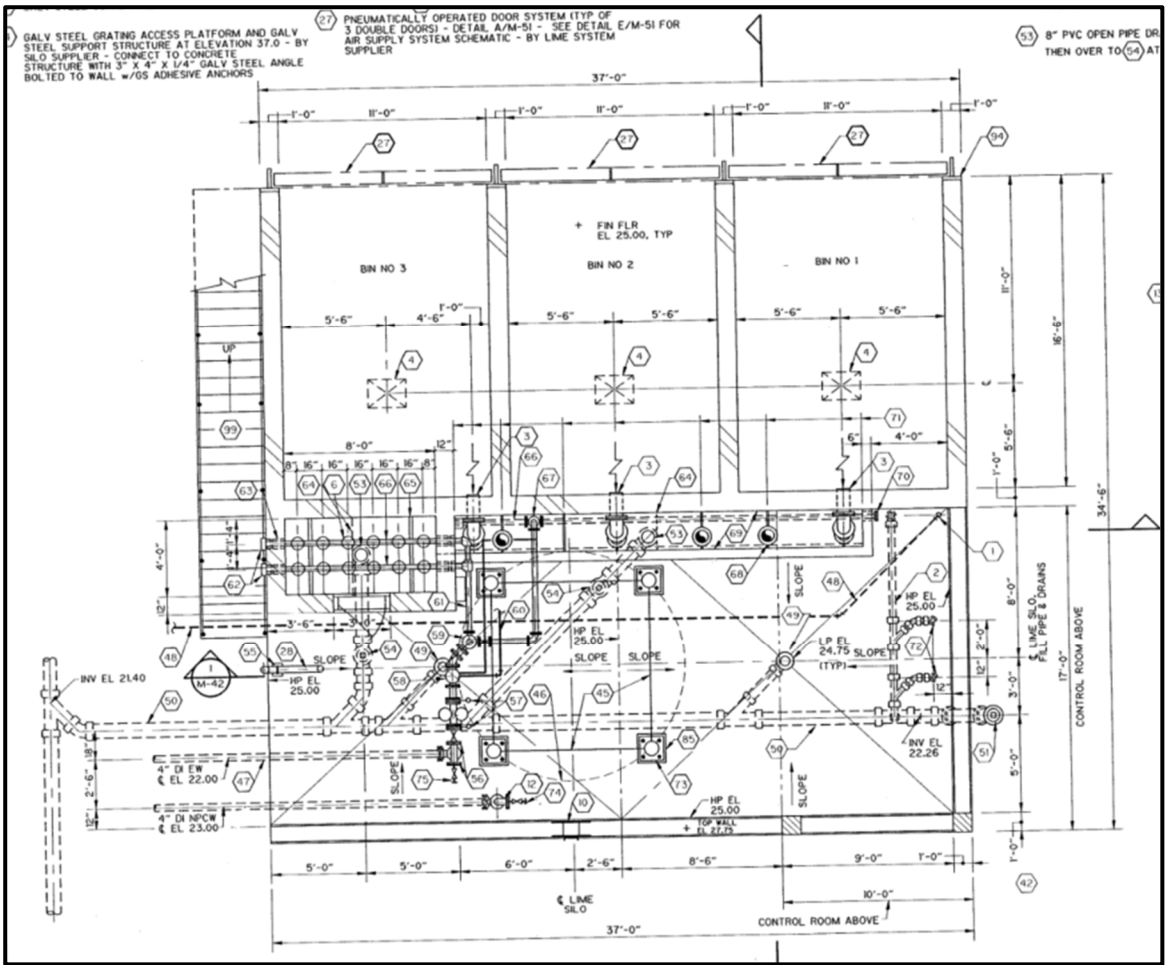


Figure 17. Existing Lime Stabilization System

Table 2.3.18. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Filtrate Pump Station					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	Figure 18 & Figure 19	Additional Information Reference:	N/A
Condition	**Age**		**Size**		
☒ Good ☐ Fair ☐ Poor ☐ N/A	Recirculation PS – 38 Pump No. 1 – 5 Pump No. 2 – 5		Pump No. 1 – 800 gpm, 14 HP Pump No. 2 – 800 gpm, 14 HP		
Additional Information					
Provide any additional information that may be helpful in describing the equipment discussed above.					
One filtrate pump station was installed in 1986. Station equipped with two Sulzer pumps installed in February 2019.					

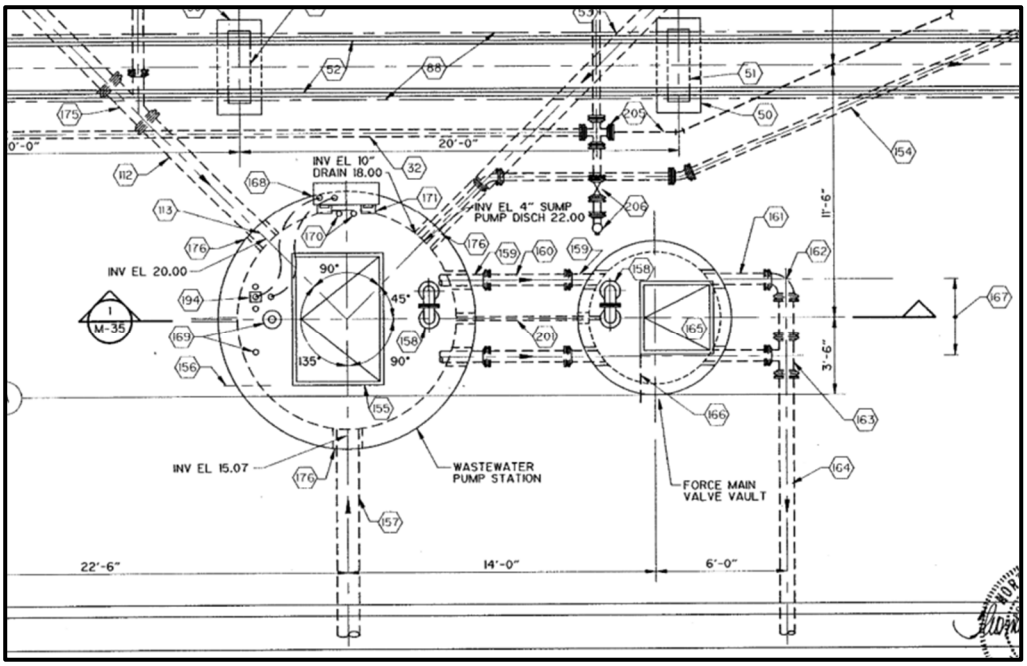


Figure 18. Existing Filtrate Pump Station – Plan

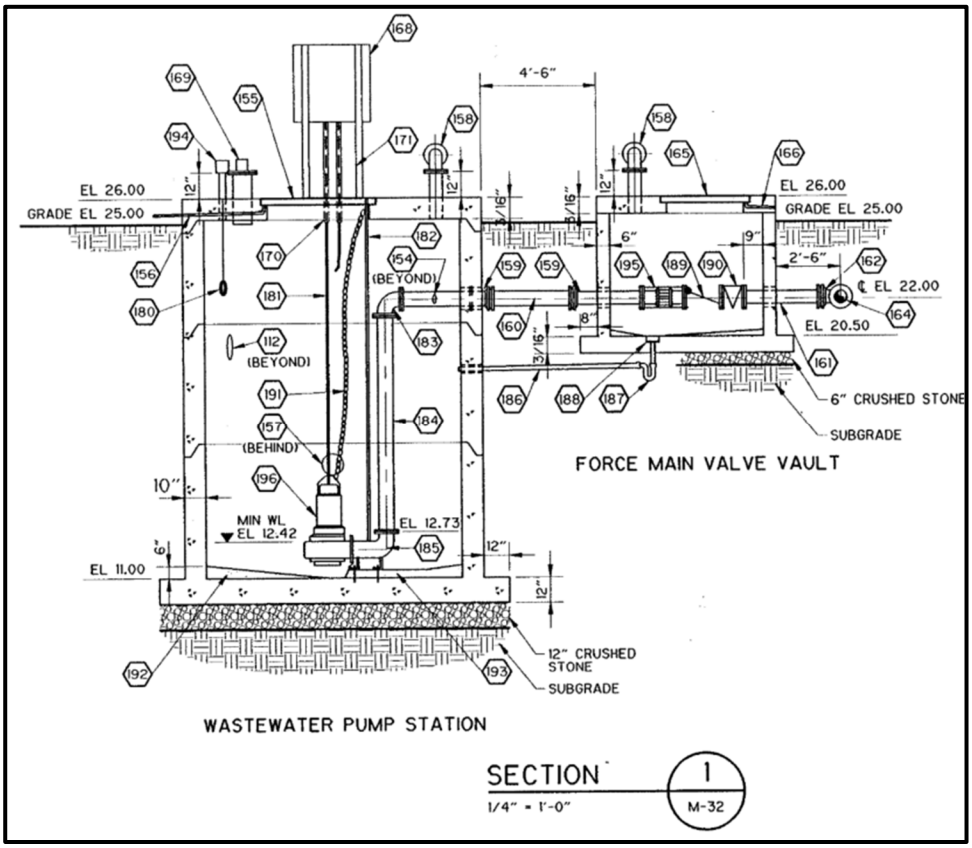


Figure 19. Existing Filtrate Pump Station – Profile

Table 2.3.19. Specific Equipment Description					
Southside WWTP Replacement & Capacity Upgrade Project					
Cape Fear Public Utility Authority					
Offsite Sludge Disposal					
For use with projects funded or co-funded by the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.					
Complete this table in accordance with Subchapter 2.2.2.2 of Part B of the guidance.					
Picture Reference:	N/A	Diagram Reference:	N/A	Additional Information Reference:	N/A
Condition		**Age**		**Size**	
☐ Good ☐ Fair ☐ Poor ☒ N/A		N/A		N/A	
Additional Information					
Provide any additional information that may be helpful in describing the equipment discussed above.					
CFPUA has two land application permits: Permit WQ0011869 – distribution of Class A residuals and Permit WQ0001271 – land application of class B residuals. According to the most recent annual biosolids reports, no land application occurred in 2023; all solids were disposed in a municipal landfill.					

Table 2.4. NPDES Permit Information	
Southside WWTP Replacement & Capacity Upgrade Project	
Cape Fear Public Utility Authority	
For use with projects funded or co-funded with the CWSRF, WW-SRP, WW-SEL, or CDBG-I programs.	
Supporting Information Appendix Reference:	Appendix D
NPDES or Non-Discharge Permit No.	NC0023973
Describe the information provided in the permit in accordance with 2.2.2.3 of Part B of the guidance	
The current NPDES permit became effective November 1, 2022, and will expire on November 30, 2026. This permit includes three tiers of effluent limitations for 16, 20, and 24 MGD. In general, the effluent limitations for 16 MGD of wastewater are more stringent than the current effluent limitations for 12 MGD of wastewater. The expanded facility will be subject to lower BOD, TSS, and NH_3 limits. Additionally, the expanded facility will be required to monitor and report Bis(2-Ethylhexyl) Phthalate with quarterly grab samples; monitoring of this analyte was not previously required. These more stringent effluent limitations require a more advanced treatment process (than trickling filters). Changes in influent wastewater characteristics are not expected.	

Table 2.5. Current Population Analysis Southside WWTP Replacement & Capacity Upgrade Project Cape Fear Public Utility Authority	
Complete the areas shown in gray. Links are to U.S. Census Bureau websites for use with this table.	
U.S. Census Place or County:	New Hanover County
Appendix Reference for U.S. Census Information:	Appendix E
Total Population from ACS:	238,852
Persons per Square Mile in LGU:	1,242.34
LGU Land Area (miles^2):	192.26
WWTP Service Area (miles^2):	86.517
% of LGU in WWTP Service Area:	45.00%
Current Population in Service Area:	**107,483**

Table 2.6. Historical Wastewater Flow Data

Southside WWTP Replacement & Capacity Upgrade Project

Cape Fear Public Utility Authority

For use with projects funded or co-funded with CWSRF, WW-SRP, WW-SEL, or the CDBG-I programs.

Provide historical flows in accordance with Subchapter 2.2.4 of Part B of the guidance.

			Historical Flow Appendix Reference:	Appendix F
	Year	**Annual Average Daily Flow (MGD)**	**Maximum Monthly Average Flow (MGD)**	**Minimum Monthly Average Flow (MGD)**
1	2020	7.418	9.445	6.325
2	2021	7.633	8.802	6.446
3	2022	7.576	8.650	6.789
4	2023	7.206	8.164	6.692
	$Q_{4\text{-yr:}}$	7.458	9.445	6.325

Provide additional discussion of flow variations in accordance with Section 3.3.2.2 of the guidance.

Generally, variations in wastewater flow due to industrial flow and unique user variations (e.g., summer peaks) are not present in the data. Based on the historical flows included in Appendix F, and available precipitation data from the NC State Climate Office, the SSWWTP experiences increased flows during and after precipitation events. This is indicative of I&I within the collection system.

The CFPUA Capital Improvements Plan for fiscal years 2023 – 2032 (Appendix G) explains how the authority utilizes asset management data to drive decisions. Based on the authority's assessment, approximately 110 miles of the system's approximate 923 miles of gravity sewer lines are approaching their end of life. Historically, aged gravity sewer lines are likely to contribute to I&I issues. CFPUA plans to invest $14.8 million in its wastewater collection and conveyance system to address such deficiencies, among others. It should be noted that the proposed expansion project is being driven by regional growth, not excessive I&I issues.

Section 3.0 Future Situation

Table 3.1. Future Population Analysis
Southside WWTP Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority

Complete the cells in gray. Note that some cells may contain pulldown menu. If so, please use pulldown menus to select data.

		SDC Data Appendix Reference:	Appendix H	
Current LGU Population:	238,852	County Name:	New Hanover	
Current Service Area Population:	107,483	Most Current County Population:	238,852	
Percentage of LGU Population in County:	100.00%	Percentage of Service Area in LGU:	45.00%	

		State Data Center			Alternate Data Source:		
	Year	County Population	LGU Population	Service Area Population	County Population	LGU Population	Service Area Population
1	2023	238,852	238,852	107,483			
2	2024	242,708	242,708	109,219			
3	2025	246,018	246,018	110,708			
4	2026	249,330	249,330	112,199			
5	2027	252,640	252,640	113,688			
6	2028	255,953	255,953	115,179			
7	2029	259,265	259,265	116,669			
8	2030	262,576	262,576	118,159			
9	2031	265,889	265,889	119,650			
10	2032	269,198	269,198	121,139			
11	2033	272,511	272,511	122,630			
12	2034	275,822	275,822	124,120			
13	2035	279,133	279,133	125,610			
14	2036	282,445	282,445	127,100			
15	2037	285,756	285,756	128,590			
16	2038	289,068	289,068	130,081			
17	2039	292,380	292,380	131,571			
18	2040	295,691	295,691	133,061			
19	2041	299,002	299,002	134,551			
20	2042	302,313	302,313	136,041			
21	2043	305,624	305,624	137,531			
22	2044	308,937	308,937	139,022			
23	2045	312,248	312,248	140,512			

If using an alternative source of data, provide a justification for use of this data below and provide supporting information in an appendix of the ER/EID.

Appendix Reference:		

Table 3.2. Future Flow Analysis
Southside WWTP Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority

							Alternative Flow Projections Used in Alternatives Analysis?				No
		Current Flow (gpd):	7,206,100				If yes, complete below.		Appendix Reference:		
		SDC Data					**Alternative Population Data Source:**				
	Year	**Residential Flow (gpd)**	**Commercial Flow (gpd)**	**Industrial Flow (gpd)**	**Diverted Flow (gpd)**	**Total Flow (gpd)**	**Residential Flow (gpd)**	**Commercial Flow (gpd)**	**Industrial Flow (gpd)**	**Diverted Flow (gpd)**	**Total Flow (gpd)**
1	2023	0	0	0	0	**7,206,100**					
2	2024	121,464	26,028	735,359	0	**8,088,951**					
3	2025	225,729	48,371	748,020	0	**8,228,219**					
4	2026	330,057	70,726	760,688	0	**8,367,572**					
5	2027	434,322	93,069	773,349	0	**8,506,840**					
6	2028	538,682	115,432	786,021	0	**8,646,235**					
7	2029	643,009	137,788	798,690	0	**8,785,587**					
8	2030	747,306	160,137	811,354	2,700,000	**11,624,897**					
9	2031	851,666	182,500	824,027	2,700,000	**11,764,292**					
10	2032	955,899	204,836	836,683	2,700,000	**11,903,518**					
11	2033	1,060,259	227,198	849,356	2,700,000	**12,042,912**					
12	2034	1,164,555	249,548	862,020	2,700,000	**12,182,223**					
13	2035	1,268,852	271,897	874,685	2,700,000	**12,321,533**					
14	2036	1,373,180	294,253	887,353	2,700,000	**12,460,885**					
15	2037	1,477,476	316,602	900,018	2,700,000	**12,600,196**					
16	2038	1,581,804	338,958	912,686	2,700,000	**12,739,548**					
17	2039	1,686,132	361,314	925,355	2,700,000	**12,878,901**					
18	2040	1,790,429	383,663	938,019	2,700,000	**13,018,211**					
19	2041	1,894,725	406,013	950,684	2,700,000	**13,157,521**					
20	2042	1,999,022	428,362	963,348	2,700,000	**13,296,832**					
21	2043	2,103,318	450,711	976,013	2,700,000	**13,436,142**					
22	2044	2,207,678	473,074	988,685	2,700,000	**13,575,536**					
23	2045	2,311,974	495,423	1,001,350	2,700,000	**13,714,847**					

If the alternative flow projection was the one accepted for use in the alternatives analysis, then provide a justification as to why the alternative flow projections are preferred over the flows developed based on SDC population projections.

Influent Mass Loadings

Table 3.3 summarizes the design flows for the SSWWTP. Table 3.4 presents the design mass loading conditions used for the process modeling of the SSWWTP at a capacity of 16 MGD. Table 3.5 summarizes the design loads that would be observed at 20 MGD and 24 MGD based on the concentrations presented in Table 3.4.

Table 3.3. SSWWTP Flow and Peaking Factor Data

Flow Criteria	Flow (MGD)	Peaking Factor	20 MGD Capacity	24 MGD Capacity
Minimum Day	7.4	0.46	9.2	11.0
Annual Average	12.5	0.78	15.6	18.7
Design Flow	16.0	1.00	20.0	24.0
Maximum 7-Day	18.7	1.16	23.2	27.8
Maximum Day	20.8	1.30	26.0	31.2
Peak Hour	40.0	2.50	50.0	60.0

Table 3.4. SSWWTP Influent Design Flow and Loads for 16 MGD

Flow Criteria	AA Concentration (mg/L)	AA Load (lb/d)	MM Peaking Factors for Design	MM Concentration (mg/L)	MM Load (lb/d)
COD	647	86,400	1.3	841	112,300
BOD	250	33,400	1.3	325	43,400
TSS	250	33,400	1.3	325	43,400
TKN	43.4	5,800	1.3	56.4	7,500
NH_3-N	30.3	4,100	1.3	39.8	5,300
TP	7.1	950	1.3	9.2	1,200

Table 3.5. SSWWTP Influent Design Flow and Loads for 20 MGD and 24 MGD

Flow Criteria	20 MGD Capacity		24 MGD Capacity	
	AA Load (lb/d)	MM Load (lb/d)	AA Load (lb/d)	MM Load (lb/d)
COD	108,000	140,300	129,500	168,400
BOD	41,700	54,200	50,100	65,100
TSS	41,700	54,200	50,100	65,100
TKN	7,300	9,400	8,700	11,300
NH_3-N	5,100	6,700	6,200	8,000
TP	1,200	1,600	1,500	1,900

Section 4.0 Need and Purpose

The proposed Southside Wastewater Treatment Plant Replacement and Capacity Upgrade project will replace and expand the existing CFPUA SSWWTP from 12 MGD to 16 MGD with provisions to expand to 20 and 24 MGD in the future. This project will include a completely new treatment process and most existing facilities will be replaced or repurposed.

Need

The wastewater flow in southern New Hanover County has been steadily increasing and is quickly approaching the SSWWTP's permitted capacity under peak conditions.

Historically, CFPUA redirected wastewater flow from the SSWWTP to the NSWWTP to make use of the existing capacity at the NSWWTP, thus avoiding the necessity of expanding the SSWWTP. Nevertheless, rapid growth in the northern region of New Hanover County has led to an increased need for treatment capacity at the NSWWTP.

Additionally, the existing trickling filters do not provide adequate nitrogen and phosphorus treatment. Replacing these units with more advanced technology will better position CFPUA to meet potential future nitrogen and phosphorus effluent limitations.

Purpose

Expanding the capacity of the SSWWTP will restore capacity at the NSWWTP and provide CFPUA with the ability to meet wastewater treatment and disposal needs in the service area of the SSWWTP. The expansion and rehabilitation effort associated with the proposed project aims to accommodate New Hanover County's growth, modernize the treatment process, replace aging infrastructure, and enhance the quality of treated effluent discharged into the Cape Fear River.

Section 5.0 Alternatives Analysis and Project Cost

5.1 Alternatives Description

The following alternatives are discussed in this section:

- No-Action Alternative
- Densification with Anaerobic Sludge Digestion (Preferred Alternative)
- Optimum Operation of Existing Facilities
- Decentralized Systems
- Regionalization
- BioDenipho with Thermal Sludge Drying

Table 5.1.1. Alternatives Description **Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project** **Cape Fear Public Utility Authority** **No-Action Alternative**	
Use this table for projects funded or co-funded by the CWSRF program only.	
Provide a description of the above alternative in accordance with Subchapter 5.1 of Part B of the guidance.	
Supporting Information Appendix Reference:	N/A
Description	
The no action alternative fails to meet the needs of the public and, as a result, was determined to be a non-viable option. Opting for the no action alternative would force the SSWWTP to maintain its current operational capacity and condition, rendering the Authority ill-prepared for the anticipated growth and increased wastewater flows of the 20-year planning period. This approach would also leave the facility vulnerable to equipment failures and thus negative environmental impacts. Furthermore, managing the heightened influent wastewater flows would necessitate costly bypass pumping or pumping and hauling procedures, along with an elevated risk of fines and potential legal obligations.	
Is Figure Included? ☐ Yes ☒ No	If Yes, Figure #: N/A
Alternative Feasibility: ☐ Feasible	☒ Infeasible
Capital Cost: $0	**Present Worth:** $0
Water Use, Reuse, Recapture, and Conservation **(CWSRF funded and co-funded projects only)**	
Check the box that most appropriately describes the water use, reuse, recapture, and conservation capabilities of the project.	
☐ The project type is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.	
☒ The scope of the project is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.	
☐ The project type or project scope requires an analysis of water use, reuse, recapture, and conservation. The analysis is briefly discussed below.	

Table 5.1.1. Alternatives Description
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
No-Action Alternative

If the third box above is checked, then check the appropriate box below and briefly provide a qualitative discussion about the water use, reuse, recapture, and conservation abilities of the alternative.

- ☒ This is the No-Action Alternative.
- ☐ This alternative provides more water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides less water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides the same water use, reuse, recapture, and/or conservation as the Preferred Alternative.
- ☐ This alternative is the Preferred Alternative.

Water Use, Reuse, Recapture, and Conservation Discussion

N/A

Energy Conservation (CWSRF funded and co-funded projects only)

Check the box that most appropriately describes the energy conservation capabilities of the project.

- ☐ The project type is not applicable to energy conservation. Therefore, no analysis has been completed.
- ☒ The scope of the project is not applicable to energy conservation. Therefore, no analysis has been completed.
- ☐ The scope of the project is applicable to energy conservation. The analysis is briefly discussed below.
- ☐ The project type is applicable to energy conservation. The analysis is briefly discussed below.

If the third box and/or fourth boxes above are checked, then check the appropriate box below and briefly provide a qualitative discussion about the energy conservation abilities of the alternative.

- ☒ This is the No-Action Alternative
- ☐ This alternative provides more energy conservation than the Preferred Alternative.
- ☐ This alternative provides less energy conservation than the Preferred Alternative.
- ☐ This alternative provides the same energy conservation as the Preferred Alternative.
- ☐ This alternative is the Preferred Alternative.

Energy Conservation Discussion

N/A

Environmental Impact Description

Provide a <u>qualitative</u> description of the environmental impacts and compare the impacts to that of the Preferred Alternative.

Table 5.1.1. Alternatives Description **Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project** **Cape Fear Public Utility Authority** **No-Action Alternative**
If the no action alternative is pursued, the SSWWTP would be vulnerable to failures and operating beyond capacity, both of which could lead to environmental harm. These negative impacts are greater than the preferred alternative, which would reduce the likelihood of failures and operating beyond capacity.
Environmental Impact Analysis
☒ Greater than Preferred Alternative ☐ Less than Preferred Alternative ☐ Same as Preferred Alternative ☐ Preferred Alternative
Acceptance/Rejection
Alternative: ☐ Accepted ☒ Rejected
Rationale for Acceptance/Rejection
Discuss the rationale for acceptance/rejection of the above-referenced alternative.
This alternative is rejected because it does not address the need for increased treatment capacity and a modernized treatment system. If the no action alternative is pursued, the SSWWTP would be vulnerable to failures and operating beyond capacity, both of which could lead to environmental harm and costly violations.

Table 5.1.2. Alternatives Description
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Densification with Activated Sludge with Anaerobic Sludge Digestion (Preferred Alternative)

Use this table for projects funded or co-funded by the CWSRF program only.

Provide a description of the above alternative in accordance with Subchapter 5.1 of Part B of the guidance.

Supporting Information Appendix Reference:	N/A

Description

The proposed SSWWTP Replacement and Capacity Upgrade project will replace and expand the existing CFPUA SSWWTP from 12 MGD to 16 MGD with provisions to expand to 20 MGD and 24 MGD in the future. This project will include a completely new treatment process, and most existing facilities will be replaced or repurposed. The proposed project includes:

- Screenings and grit removal facility with flow measurement
- Primary clarifiers and primary sludge pumping
- Aeration basins and blower building
- Secondary clarifiers and return and waste activated sludge pumping
- Tertiary filters
- Ultraviolet disinfection facility
- Outfall
- Reclaimed water pump station
- Drain pump station
- Thickening and dewatering equipment and building
- Filtrate pump station
- Liquid sludge storage tanks
- Anaerobic digesters and digester control building
- Digester gas handling and utilization facilities
- Modifications to the existing cake storage with offsite cake solids receiving
- Septage/Vactor truck receiving station
- Odor control facilities
- Chemical storage and feed facilities
- Administration building with observation deck and laboratory
- Generators
- SCADA network

Is Figure Included? ☒ Yes ☐ No	If Yes, Figure #: Figure 20
Alternative Feasibility: ☒ Feasible	☐ Infeasible
Capital Cost: $246,767,584	**Present Worth:** $293,396,281

Table 5.1.2. Alternatives Description
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority

Water Use, Reuse, Recapture, and Conservation
(CWSRF funded and co-funded projects only)

Check the box that most appropriately describes the water use, reuse, recapture, and conservation capabilities of the project.

- ☐ The project type is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.
- ☒ The scope of the project is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.
- ☐ The project type or project scope requires an analysis of water use, reuse, recapture, and conservation. The analysis is briefly discussed below.

If the third box above is checked, then check the appropriate box below and briefly provide a qualitative discussion about the water use, reuse, recapture, and conservation abilities of the alternative.

- ☐ This is the No-Action Alternative.
- ☐ This alternative provides more water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides less water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides the same water use, reuse, recapture, and/or conservation as the Preferred Alternative.
- ☒ This alternative is the Preferred Alternative.

Water Use, Reuse, Recapture, and Conservation Discussion

N/A

Energy Conservation (CWSRF funded and co-funded projects only)

Check the box that most appropriately describes the energy conservation capabilities of the project.

- ☐ The project type is not applicable to energy conservation. Therefore, no analysis has been completed.
- ☒ The scope of the project is not applicable to energy conservation. Therefore, no analysis has been completed.
- ☐ The scope of the project is applicable to energy conservation. The analysis is briefly discussed below.
- ☐ The project type is applicable to energy conservation. The analysis is briefly discussed below.

If the third box and/or fourth boxes above are checked, then check the appropriate box below and briefly provide a qualitative discussion about the energy conservation abilities of the alternative.

Table 5.1.2. Alternatives Description
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority

☐ This is the No-Action Alternative
☐ This alternative provides more energy conservation than the Preferred Alternative.
☐ This alternative provides less energy conservation than the Preferred Alternative.
☐ This alternative provides the same energy conservation as the Preferred Alternative.
☒ This alternative is the Preferred Alternative.

Energy Conservation Discussion

N/A

Environmental Impact Description

Provide a qualitative description of the environmental impacts and compare the impacts to that of the Preferred Alternative.

Environmental impacts of this alternative include minor, temporary, direct construction impacts to soils, topography, noise, and air as construction takes place. Mitigation is proposed to minimize these impacts, including reduction of the construction area to the greatest extent practical, utilization of silt fences to keep sedimentation onsite, restriction of construction to weekdays during daylight hours, and reduction of dust. No significant secondary and cumulative impacts are anticipated to occur. The existing local government and state requirements are anticipated to be sufficient to mitigate any impacts of the proposed project.

The proposed project will also relocate the UV disinfection units out of the 100-year floodplain (and the 500-year floodplain) which will improve the overall resilience, reliability, and performance of the SSWWTP. The proposed project will not affect the 500-year floodplain. No structures will be installed within the 500-year floodplain. This ultimately benefits both the environment and community the SSWWTP serves.

Environmental Impact Analysis

☐ Greater than Preferred Alternative
☐ Less than Preferred Alternative
☐ Same as Preferred Alternative
☒ Preferred Alternative

Acceptance/Rejection

Alternative: ☒ Accepted ☐ Rejected

Rationale for Acceptance/Rejection

Discuss the rationale for acceptance/rejection of the above-referenced alternative.

This alternative was accepted because it is the most feasible alternative that meets the needs and purpose of the project, has the lowest estimated present worth, and minimizes potential environmental impacts.

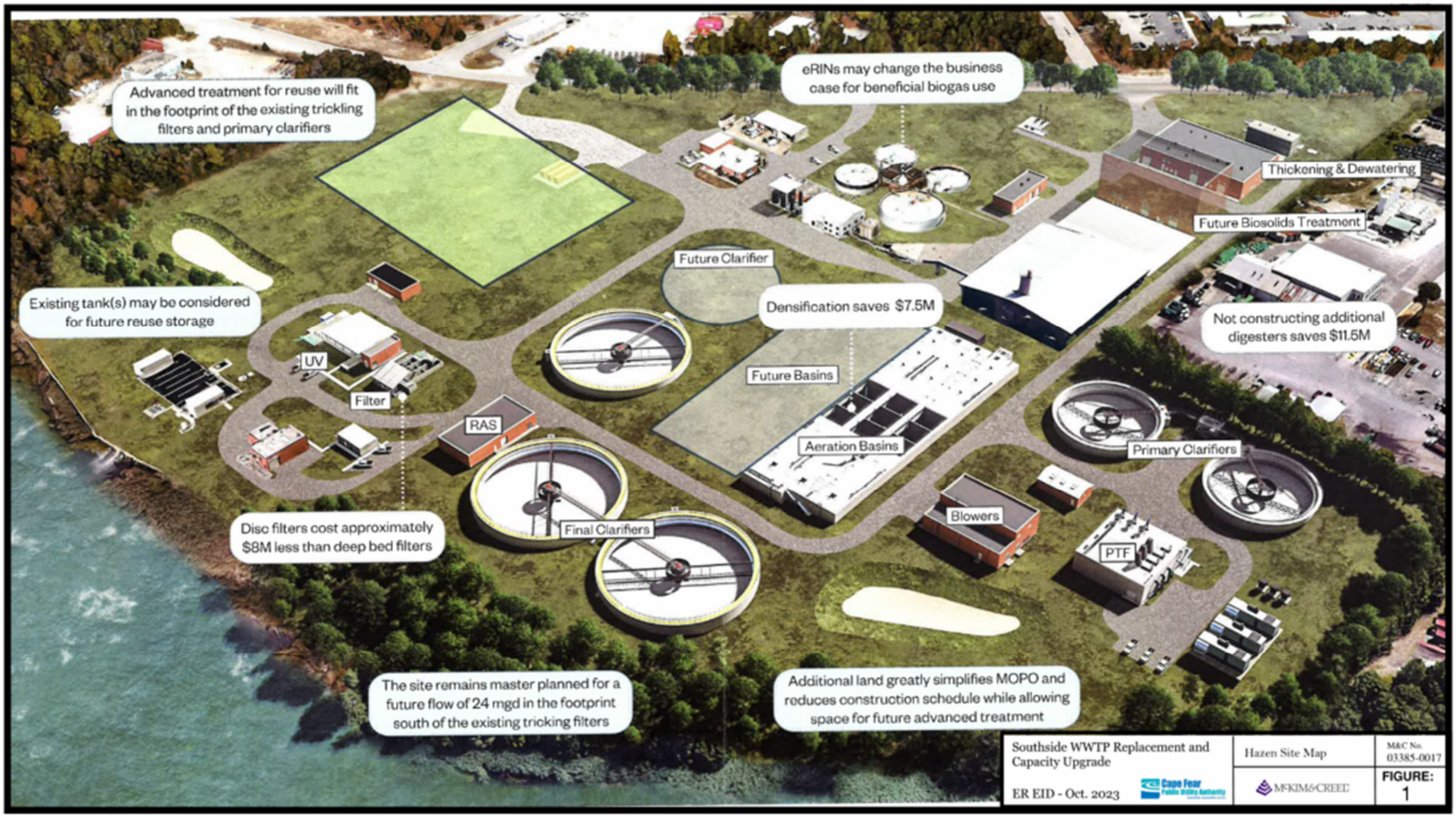


Figure 20. Preferred Alternative Site Plan

Table 5.1.3. Alternatives Description Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project Cape Fear Public Utility Authority Optimum Operation of Existing Facilities	
Use this table for projects funded or co-funded by the CWSRF program only.	
Provide a description of the above alternative in accordance with Subchapter 5.1 of Part B of the guidance.	
Supporting Information Appendix Reference:	N/A
Description	
A proposed SSWWTP optimization project would involve conducting normal maintenance procedures to improve the performance of existing equipment. This alternative would not address the facility's inability to treat projected flows. For this reason, this alternative was deemed infeasible.	
Is Figure Included? ☐ Yes ☒ No	If Yes, Figure #: N/A
Alternative Feasibility: ☐ Feasible	☒ Infeasible
Capital Cost: N/A	**Present Worth:** N/A
Water Use, Reuse, Recapture, and Conservation (CWSRF funded and co-funded projects only)	
Check the box that most appropriately describes the water use, reuse, recapture, and conservation capabilities of the project.	
☐ The project type is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed. ☒ The scope of the project is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed. ☐ The project type or project scope requires an analysis of water use, reuse, recapture, and conservation. The analysis is briefly discussed below.	
If the third box above is checked, then check the appropriate box below and briefly provide a qualitative discussion about the water use, reuse, recapture, and conservation abilities of the alternative.	
☐ This is the No-Action Alternative. ☐ This alternative provides more water use, reuse, recapture, and/or conservation than the Preferred Alternative. ☐ This alternative provides less water use, reuse, recapture, and/or conservation than the Preferred Alternative. ☐ This alternative provides the same water use, reuse, recapture, and/or conservation as the Preferred Alternative. ☐ This alternative is the Preferred Alternative.	
Water Use, Reuse, Recapture, and Conservation Discussion	
N/A	
Energy Conservation (CWSRF funded and co-funded projects only)	
Check the box that most appropriately describes the energy conservation capabilities of the project.	

Table 5.1.3. Alternatives Description **Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project** **Cape Fear Public Utility Authority**
☐ The project type is not applicable to energy conservation. Therefore, no analysis has been completed. ☒ The scope of the project is not applicable to energy conservation. Therefore, no analysis has been completed. ☐ The scope of the project is applicable to energy conservation. The analysis is briefly discussed below. ☐ The project type is applicable to energy conservation. The analysis is briefly discussed below.
If the third box and/or fourth boxes above are checked, then check the appropriate box below and briefly provide a qualitative discussion about the energy conservation abilities of the alternative.
☐ This is the No-Action Alternative ☐ This alternative provides more energy conservation than the Preferred Alternative. ☐ This alternative provides less energy conservation than the Preferred Alternative. ☐ This alternative provides the same energy conservation as the Preferred Alternative. ☐ This alternative is the Preferred Alternative.
Energy Conservation Discussion
N/A
Environmental Impact Description
Provide a qualitative description of the environmental impacts and compare the impacts to that of the Preferred Alternative.
Performing routine maintenance on existing equipment would likely result in minimal environmental impacts. There could be impacts to air quality and noise levels; however, these would be expected to be minimal. The environmental impacts of this alternative would likely be less than the preferred alternative.
Environmental Impact Analysis
☐ Greater than Preferred Alternative ☒ Less than Preferred Alternative ☐ Same as Preferred Alternative ☐ Preferred Alternative
Acceptance/Rejection
Alternative: ☐ Accepted ☒ Rejected
Rationale for Acceptance/Rejection
Discuss the rationale for acceptance/rejection of the above-referenced alternative.
Optimization of the SSWWTP does not address the facility's inability to treat projected flows. For this reason, this alternative was deemed infeasible and rejected.

Table 5.1.4. Alternatives Description
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Decentralized Systems

Use this table for projects funded or co-funded by the CWSRF program only.

Provide a description of the above alternative in accordance with Subchapter 5.1 of Part B of the guidance.

Supporting Information Appendix Reference:	N/A

Description

A proposed SSWWTP decentralization project would involve constructing individual and/or clustered treatment systems for a portion of the facility's 76,813 residential and 6,528 nonresidential connections. Although diverting flow from the SSWTP to individual and/or clustered treatment facilities would reduce the capacity needs of the facility, a significant number of connections would need to switch to individual and/or clustered treatment systems for the reduction to be meaningful. Such an undertaking would require extensive permitting, financing, and construction coordination. Once these systems were installed, they would need to be monitored, repaired, and replaced by qualified individuals. For these reasons, this alternative was deemed infeasible.

Is Figure Included? ☐ Yes ☒ No	If Yes, Figure #: N/A
Alternative Feasibility: ☐ Feasible	☒ Infeasible
Capital Cost: N/A	**Present Worth:** N/A

Water Use, Reuse, Recapture, and Conservation
(CWSRF funded and co-funded projects only)

Check the box that most appropriately describes the water use, reuse, recapture, and conservation capabilities of the project.

- ☐ The project type is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.
- ☒ The scope of the project is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.
- ☐ The project type or project scope requires an analysis of water use, reuse, recapture, and conservation. The analysis is briefly discussed below.

If the third box above is checked, then check the appropriate box below and briefly provide a qualitative discussion about the water use, reuse, recapture, and conservation abilities of the alternative.

- ☐ This is the No-Action Alternative.
- ☐ This alternative provides more water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides less water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides the same water use, reuse, recapture, and/or conservation as the Preferred Alternative.
- ☐ This alternative is the Preferred Alternative.

Table 5.1.4. Alternatives Description **Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project** **Cape Fear Public Utility Authority**
Water Use, Reuse, Recapture, and Conservation Discussion
N/A
Energy Conservation (CWSRF funded and co-funded projects only)
Check the box that most appropriately describes the energy conservation capabilities of the project.
☐ The project type is not applicable to energy conservation. Therefore, no analysis has been completed. ☒ The scope of the project is not applicable to energy conservation. Therefore, no analysis has been completed. ☐ The scope of the project is applicable to energy conservation. The analysis is briefly discussed below. ☐ The project type is applicable to energy conservation. The analysis is briefly discussed below.
If the third box and/or fourth boxes above are checked, then check the appropriate box below and briefly provide a qualitative discussion about the energy conservation abilities of the alternative.
☐ This is the No-Action Alternative ☐ This alternative provides more energy conservation than the Preferred Alternative. ☐ This alternative provides less energy conservation than the Preferred Alternative. ☐ This alternative provides the same energy conservation as the Preferred Alternative. ☐ This alternative is the Preferred Alternative.
Energy Conservation Discussion
N/A
Environmental Impact Description
Provide a <u>qualitative</u> description of the environmental impacts and compare the impacts to that of the Preferred Alternative.
The installation of individual and/or clustered treatment systems would likely cause permanent impacts to floodplains, soils, wetlands, water resources, and T&E species. These environmental impacts would likely be greater than the preferred alternative since the preferred alternative would affect less area.
Environmental Impact Analysis
☒ Greater than Preferred Alternative ☐ Less than Preferred Alternative ☐ Same as Preferred Alternative ☐ Preferred Alternative
Acceptance/Rejection
Alternative: ☐ Accepted ☒ Rejected
Rationale for Acceptance/Rejection
Discuss the rationale for acceptance/rejection of the above-referenced alternative.

Table 5.1.4. Alternatives Description Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project Cape Fear Public Utility Authority
Construction of hundreds of individual and/or clustered treatment systems would be extremely expensive and require extensive permitting and construction coordination. Such systems would need to be monitored and maintained by qualified individuals. The costs associated with installation and repair would be burdensome to both CFPUA and/or individual customers. For these reasons, this alternative was deemed infeasible.

Table 5.1.5. Alternatives Description
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Regionalization

Use this table for projects funded or co-funded by the CWSRF program only.

Provide a description of the above alternative in accordance with Subchapter 5.1 of Part B of the guidance.

Supporting Information Appendix Reference:	N/A

Description

The proposed SSWWTP regionalization project would involve conveying all wastewater from the SSWWTP to a nearby wastewater treatment facility. CFPUA owns and operates the NSWWTP, which is situated on 23rd Street in Wilmington, NC. This facility is permitted for 16 MGD. The NSWWTP does not have sufficient capacity to treat the projected flow from the SSWWTP service area. Even if the NSWWTP was expanded to its 24 MGD footprint, it would lack capacity to accommodate its own projected service area demands and the projected demands from the SSWTP service area. There are no municipal wastewater treatment facilities with sufficient treatment capacity within a 10-mile radius of the SSWWTP. For this reason, a SSWWTP regionalization alternative was deemed infeasible.

Is Figure Included? ☐ Yes ☒ No	If Yes, Figure #: N/A
Alternative Feasibility: ☐ Feasible	☒ Infeasible
Capital Cost: N/A	**Present Worth:** N/A

Water Use, Reuse, Recapture, and Conservation
(CWSRF funded and co-funded projects only)

Check the box that most appropriately describes the water use, reuse, recapture, and conservation capabilities of the project.

- ☐ The project type is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.
- ☒ The scope of the project is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.
- ☐ The project type or project scope requires an analysis of water use, reuse, recapture, and conservation. The analysis is briefly discussed below.

If the third box above is checked, then check the appropriate box below and briefly provide a qualitative discussion about the water use, reuse, recapture, and conservation abilities of the alternative.

- ☐ This is the No-Action Alternative.
- ☐ This alternative provides more water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides less water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides the same water use, reuse, recapture, and/or conservation as the Preferred Alternative.
- ☐ This alternative is the Preferred Alternative.

Table 5.1.5. Alternatives Description **Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project** **Cape Fear Public Utility Authority**
Water Use, Reuse, Recapture, and Conservation Discussion
N/A
Energy Conservation (CWSRF funded and co-funded projects only)
Check the box that most appropriately describes the energy conservation capabilities of the project.
☐ The project type is not applicable to energy conservation. Therefore, no analysis has been completed. ☒ The scope of the project is not applicable to energy conservation. Therefore, no analysis has been completed. ☐ The scope of the project is applicable to energy conservation. The analysis is briefly discussed below. ☐ The project type is applicable to energy conservation. The analysis is briefly discussed below.
If the third box and/or fourth boxes above are checked, then check the appropriate box below and briefly provide a qualitative discussion about the energy conservation abilities of the alternative.
☐ This is the No-Action Alternative ☐ This alternative provides more energy conservation than the Preferred Alternative. ☐ This alternative provides less energy conservation than the Preferred Alternative. ☐ This alternative provides the same energy conservation as the Preferred Alternative. ☐ This alternative is the Preferred Alternative.
Energy Conservation Discussion
N/A
Environmental Impact Description
Provide a <u>qualitative</u> description of the environmental impacts and compare the impacts to that of the Preferred Alternative.
The installation of force main(s) for this alternative would likely cause permanent impacts to floodplains, land use, and wetlands. Depending on the route(s) of such force main(s) prime and unique farmlands, forest resources, and T&E species could be negatively impacted. These environmental impacts would likely be greater than the preferred alternative since the preferred alternative would affect less area.
Environmental Impact Analysis
☒ Greater than Preferred Alternative ☐ Less than Preferred Alternative ☐ Same as Preferred Alternative ☐ Preferred Alternative
Acceptance/Rejection
Alternative: ☐ Accepted ☒ Rejected
Rationale for Acceptance/Rejection

Table 5.1.5. Alternatives Description **Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project** **Cape Fear Public Utility Authority**
Discuss the rationale for acceptance/rejection of the above-referenced alternative.
There are no municipal wastewater treatment facilities with sufficient treatment capacity within a 10-mile radius of the SSWWTP. For this reason, a SSWWTP regionalization project was deemed infeasible and rejected.

Table 5.1.6. Alternatives Description
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
BioDenipho with Thermal Sludge Drying

Use this table for projects funded or co-funded by the CWSRF program only.

Provide a description of the above alternative in accordance with Subchapter 5.1 of Part B of the guidance.

Supporting Information Appendix Reference:	N/A

Description

In this alternative, the existing CFPUA SSWWTP would be expanded from 12 MGD to 16 MGD with provisions to expand to 20 MGD and 24 MGD in the future. This project would include a completely new treatment process, and most existing facilities would be replaced or repurposed. The proposed project includes:

- Screenings and grit removal facility with flow measurement
- Four BioDenipho biological nutrient removal (BNR). Each BNR train would have a 4-stage anaerobic selector, dual oxidation ditches, a three-cell post-anoxic zone and a reaeration zone. Aeration would be provided by fine bubble diffusers by three 450 HP and three 300 HP centrifugal blowers.
  Process Dimensions are as follows:

	Values
Anaerobic Selector	
Number of trains	4
Number of stages per train	4
Volume of per stage	0.093 MG
Total volume	1.49 MG
Oxidation Ditch	
Number of trains	4
Number of ditches per train	2
Volume per ditch	1.53 MG
Total volume	12.24 MG
Post-anoxic Reactor	
Number of trains	4
Number of stages per train	3
Volume of per stage	0.11 MG
Total volume	1.32 MG
Reaeration Reactor	
Number of trains	4
Number of stages per train	1
Volume of per stage	0.11 MG
Total volume	0.44 MG

- Four 130-ft diameter secondary clarifiers with 14 ft SWD. Each clarifier would have a dedicated return and waste activated sludge (RAS) pumping station. Each RAS pumping station would have one on-duty and one standby RAS pump. Each pump would be rated at 4 MGD. One WAS pump would be rated at 700 gpm in each RAS pumping station.

Table 5.1.6. Alternatives Description
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority

- Six cloth media discfilters, five on-duty and one standby, each rated at 9 MGD
- Three ultraviolet disinfection channels, two duty/one standby
- Outfall
- Reclaimed water pump station
- Drain pump station
- Thickening and dewatering equipment and building with three 2-meter gravity belt thickeners and three 2-meter belt filter presses
- Two thermal biosolids belt dryers
- Cake solids loading and receiving station
- Two cake storage silos
- Two dry pellets storage silos
- Septage/Vactor truck receiving station
- Odor control facilities
- Chemical storage and feed facilities
- Administration building with observation deck and laboratory
- Generators
- SCADA network

Is Figure Included? ☒ Yes ☐ No	If Yes, Figure #: Figure 21 and Figure 22
Alternative Feasibility: ☒ Feasible	☐ Infeasible
Capital Cost: $359,955,458	**Present Worth:** $406,505,308

Water Use, Reuse, Recapture, and Conservation
(CWSRF funded and co-funded projects only)

Check the box that most appropriately describes the water use, reuse, recapture, and conservation capabilities of the project.

☐ The project type is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.

☒ The scope of the project is not applicable to water use, reuse, recapture, and conservation. Therefore, no analysis has been completed.

☐ The project type or project scope requires an analysis of water use, reuse, recapture, and conservation. The analysis is briefly discussed below.

If the third box above is checked, then check the appropriate box below and briefly provide a qualitative discussion about the water use, reuse, recapture, and conservation abilities of the alternative.

Table 5.1.6. Alternatives Description
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority

- ☐ This is the No-Action Alternative.
- ☐ This alternative provides more water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides less water use, reuse, recapture, and/or conservation than the Preferred Alternative.
- ☐ This alternative provides the same water use, reuse, recapture, and/or conservation as the Preferred Alternative.
- ☐ This alternative is the Preferred Alternative.

Water Use, Reuse, Recapture, and Conservation Discussion

N/A

Energy Conservation (CWSRF funded and co-funded projects only)

Check the box that most appropriately describes the energy conservation capabilities of the project.

- ☐ The project type is not applicable to energy conservation. Therefore, no analysis has been completed.
- ☒ The scope of the project is not applicable to energy conservation. Therefore, no analysis has been completed.
- ☐ The scope of the project is applicable to energy conservation. The analysis is briefly discussed below.
- ☐ The project type is applicable to energy conservation. The analysis is briefly discussed below.

If the third box and/or fourth boxes above are checked, then check the appropriate box below and briefly provide a qualitative discussion about the energy conservation abilities of the alternative.

- ☐ This is the No-Action Alternative
- ☐ This alternative provides more energy conservation than the Preferred Alternative.
- ☐ This alternative provides less energy conservation than the Preferred Alternative.
- ☐ This alternative provides the same energy conservation as the Preferred Alternative.
- ☐ This alternative is the Preferred Alternative.

Energy Conservation Discussion

N/A

Environmental Impact Description

Provide a qualitative description of the environmental impacts and compare the impacts to that of the Preferred Alternative.

Table 5.1.6. Alternatives Description **Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project** **Cape Fear Public Utility Authority**
This alternative results in similar impacts as the preferred alternative. Environmental impacts of this alternative include minor, temporary, direct construction impacts to soils, topography, noise, and air as construction takes place. Mitigation is proposed to minimize these impacts, including reduction of the construction area to the greatest extent practical, utilization of silt fences to keep sedimentation onsite, restriction of construction to weekdays during daylight hours, and minimization of dust. No significant secondary and cumulative impacts are anticipated to occur. The existing local government and state requirements are anticipated to be sufficient to mitigate any impacts of the proposed project. The proposed project will also relocate the UV disinfection units out of the 100-year floodplain which will improve the overall resilience, reliability, and performance of the SSWWTP. This ultimately benefits both the environment and community the SSWWTP serves.
Environmental Impact Analysis
☐ Greater than Preferred Alternative ☐ Less than Preferred Alternative ☒ Same as Preferred Alternative ☐ Preferred Alternative
Acceptance/Rejection
Alternative: ☐ Accepted ☒ Rejected
Rationale for Acceptance/Rejection
Discuss the rationale for acceptance/rejection of the above-referenced alternative.
This alternative would require more tankage and more space for expansion, which would result in a substantially higher construction cost than that of the preferred alternative.

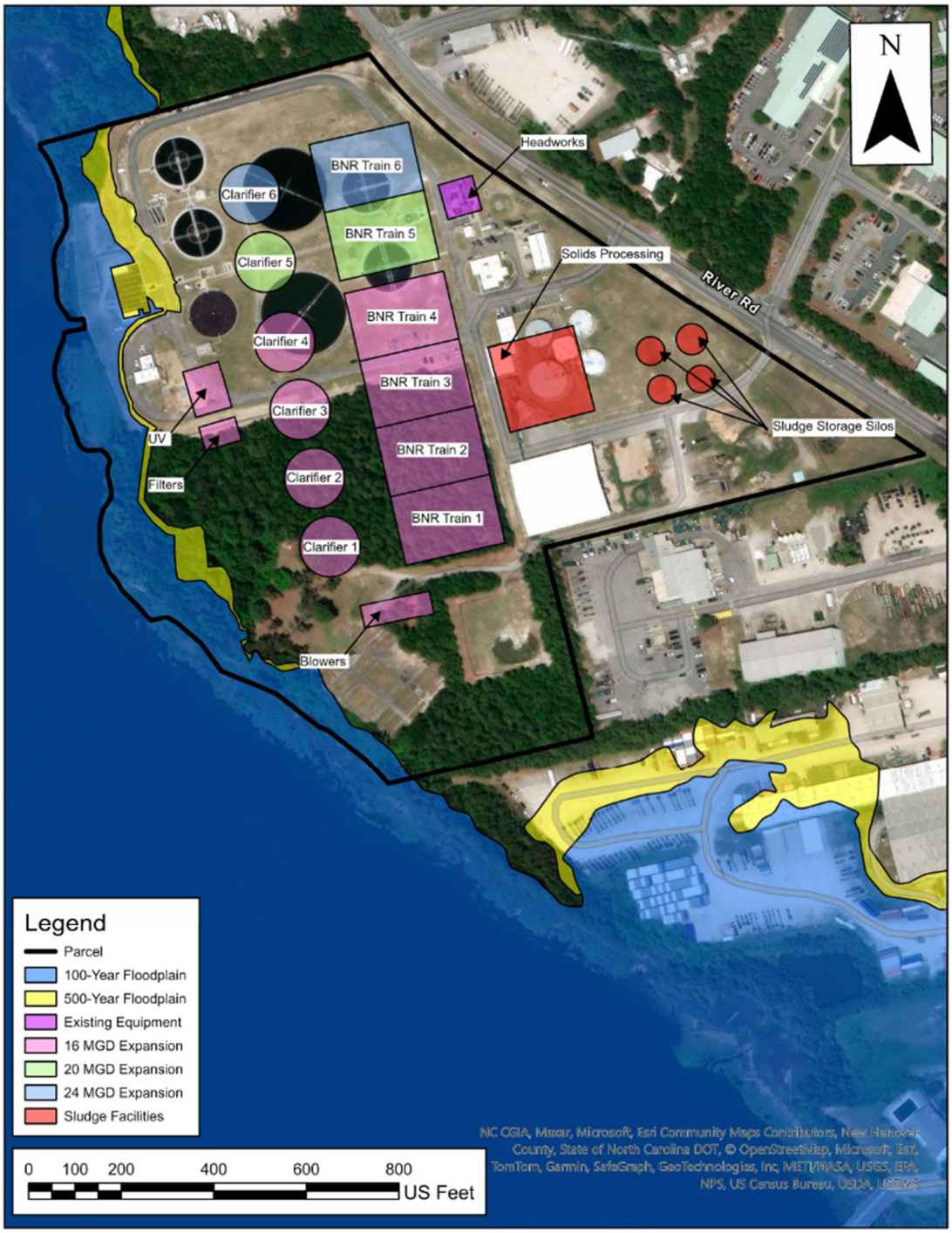


Figure 21. BioDenipho with Thermal Sludge Drying Alternative – Site Plan

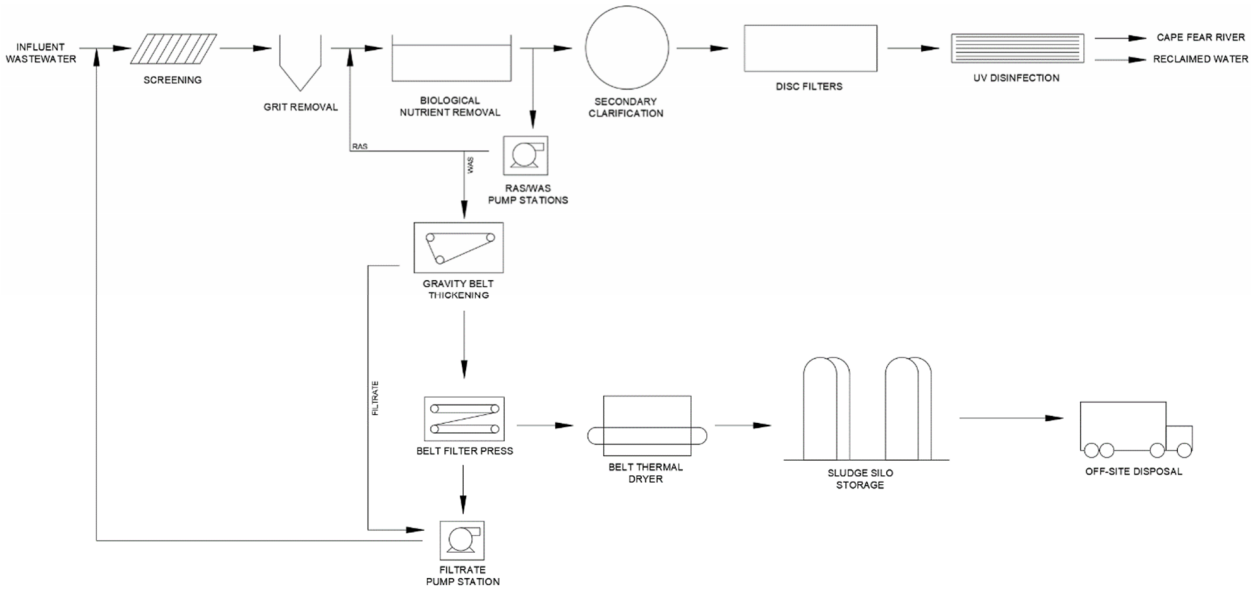


Figure 22. BioDenipho with Thermal Sludge Drying Alternative – Process Flow Diagram

5.2 Present Worth Analysis

Table 5.2.1.1. Capital Costs Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project Cape Fear Public Utility Authority				
Densification with Anaerobic Sludge Digestion (Preferred Alternative)				
Project Administration ($):	$8,622,000			
Component	**Unit Cost[a]**	**Unit**	**Quantity**	**Total Cost**
Yard Piping	$38,150,523	LS	1	$38,150,523
Sitework	$11,413,690	LS	1	$11,413,690
Maintenance Building	$400,952	LS	1	$400,952
Administration Building	$1,435,482	LS	1	$1,435,482
Headworks Structures	$5,498,000	LS	1	$5,498,000
Headworks Equipment	$5,559,925	LS	1	$5,559,925
Primary Clarifiers	$2,535,000	LS	1	$2,535,000
Primary Clarifier Equipment	$2,021,275	LS	1	$2,021,275
Primary Sludge P.S. Structure	$1,092,673	LS	1	$1,092,673
Primary Sludge Pumps	$1,001,507	LS	1	$1,001,507
Step Feed Dist. Box	$997,261	LS	1	$997,261
Aeration Basins	$35,183,313	LS	1	$35,183,313
Blowers/Diffusers	$9,213,572	LS	1	$9,213,572
Secondary Clarifiers	$4,907,076	LS	1	$4,907,076
Secondary Clarifier Equipment	$3,912,643	LS	1	$3,912,643
RAS/WAS P.S.	$1,462,358	LS	1	$1,462,358
Pumps	$1,340,348	LS	1	$1,340,348
Filters	$10,108,209	LS	1	$10,108,209
Filter Structures	$6,578,336	LS	1	$6,578,336
BWW/EQ	$1,281,900	LS	1	$1,281,900
EQ Meter Vault	$221,841	LS	1	$221,841
UV Disinfection Structure	$4,879,642	LS	1	$4,879,642
UV Disinfection Equipment	$5,720,266	LS	1	$5,720,266
Odor Control	$3,359,698	LS	1	$3,359,698
Anaerobic Digesters A&B (2 New Units)	$12,504,329	LS	1	$12,504,329
Anaerobic Digester C (Rehab)	$5,926,229	LS	1	$5,926,229
Thickening and Dewatering Building	$8,570,380	LS	1	$8,570,380
Thickeners	$3,791,444	LS	1	$3,791,444
Belt Filter Press	$5,687,166	LS	1	$5,687,166
Filtrate P.S.	$337,632	LS	1	$337,632
Filtrate Pumps	$309,462	LS	1	$309,462
Sludge Storage Tanks	$1,482,581	LS	1	$1,482,581
Gas Handling Boiler Facility	$4,597,912	LS	1	$4,597,912
Sludge Pad Modifications	$267,301	LS	1	$267,301
Generators	$11,468,570	LS	1	$11,468,570
Instrumentation & Control	$2,004,761	LS	1	$2,004,761
			Total Construction Cost:	**$215,223,258**
			Construction Contingency Cost:	**$21,522,326**
			Project Administration Cost:	**$8,622,000**
			SRF Loan Fee Cost:	**$1,400,000**
			Total Capital Cost:	**$246,767,584**

Table 5.2.1.2. Project Cost Life Cycle Assumptions Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project Cape Fear Public Utility Authority Densification with Anaerobic Sludge Digestion (Preferred Alternative)			
Complete the areas shown in gray.			
Component	**Expected Life Cycle**	**Replacement Expected? †**	**Rationale for Expected Life Cycle**
Yard Piping	40	N	Engineering Judgement
Sitework	N/A	N/A	N/A
Maintenance Building	30	N	Engineering Judgement
Administration Building	30	N	Engineering Judgement
Headworks Structures	30	N	Engineering Judgement
Headworks Equipment	25	N	Engineering Judgement
Primary Clarifiers	30	N	Engineering Judgement
Primary Clarifier Equipment	25	N	Engineering Judgement
Primary Sludge P.S. Structure	40	N	Engineering Judgement
Primary Sludge Pumps	20	Y	Engineering Judgement
Step Feed Dist. Box	40	N	Engineering Judgement
Aeration Basins	30	N	Engineering Judgement
Blowers/Diffusers	25	N	Engineering Judgement
Secondary Clarifiers	30	N	Engineering Judgement
Secondary Clarifier Equipment	25	N	Engineering Judgement
RAS/WAS P.S.	30	N	Engineering Judgement
Pumps	20	Y	Engineering Judgement
Filters	15	Y	Engineering Judgement
Filter Structures	30	N	Engineering Judgement
BWW/EQ	30	N	Engineering Judgement
EQ Meter Vault	40	N	Engineering Judgement
UV Disinfection Structure	30	N	Engineering Judgement
UV Disinfection Equipment	25	N	Engineering Judgement
Odor Control	10	Y	Engineering Judgement
Anaerobic Digesters A&B (2 New Units)	30	N	Engineering Judgement
Anaerobic Digester C (Rehab)	20	Y	Engineering Judgement
Thickening and Dewatering Building	40	N	Engineering Judgement
Thickeners	25	N	Engineering Judgement
Belt Filter Press	25	N	Engineering Judgement
Filtrate P.S.	40	N	Engineering Judgement
Filtrate Pumps	20	Y	Engineering Judgement
Sludge Storage Tanks	50	N	Engineering Judgement
Gas Handling Boiler Facility	25	N	Engineering Judgement
Sludge Pad Modifications	30	N	Engineering Judgement
Generators	20	Y	Engineering Judgement
Instrumentation & Control	40	N	Engineering Judgement

Table 5.2.1.3. Replacement Costs (Years 1 to 5)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Densification with Anaerobic Sludge Digestion (Preferred Alternative)

Current Inflation Rate based on Construction Cost Index: 2.97% EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of Replacement Costs in Year: 1	2	3	4	5
Yard Piping	$38,150,523	LS	1	$0	$0	$0	$0	$0
Sitework	$11,413,690	LS	1	$0	$0	$0	$0	$0
Maintenance Building	$400,952	LS	1	$0	$0	$0	$0	$0
Administration Building	$1,435,482	LS	1	$0	$0	$0	$0	$0
Headworks Structures	$5,498,000	LS	1	$0	$0	$0	$0	$0
Headworks Equipment	$5,559,925	LS	1	$0	$0	$0	$0	$0
Primary Clarifiers	$2,535,000	LS	1	$0	$0	$0	$0	$0
Primary Clarifier Equipment	$2,021,275	LS	1	$0	$0	$0	$0	$0
Primary Sludge P.S. Structure	$1,092,673	LS	1	$0	$0	$0	$0	$0
Primary Sludge Pumps	$1,001,507	LS	1	$0	$0	$0	$0	$0
Step Feed Dist. Box	$997,261	LS	1	$0	$0	$0	$0	$0
Aeration Basins	$35,183,313	LS	1	$0	$0	$0	$0	$0
Blowers/Diffusers	$9,213,572	LS	1	$0	$0	$0	$0	$0
Secondary Clarifiers	$4,907,076	LS	1	$0	$0	$0	$0	$0
Secondary Clarifier Equipment	$3,912,643	LS	1	$0	$0	$0	$0	$0
RAS/WAS P.S.	$1,462,358	LS	1	$0	$0	$0	$0	$0
Pumps	$1,340,348	LS	1	$0	$0	$0	$0	$0
Filters	$10,108,209	LS	1	$0	$0	$0	$0	$0
Filter Structures	$6,578,336	LS	1	$0	$0	$0	$0	$0
BWW/EQ	$1,281,900	LS	1	$0	$0	$0	$0	$0
EQ Meter Vault	$221,841	LS	1	$0	$0	$0	$0	$0
UV Disinfection Structure	$4,879,642	LS	1	$0	$0	$0	$0	$0
UV Disinfection Equipment	$5,720,266	LS	1	$0	$0	$0	$0	$0
Odor Control	$3,359,698	LS	1	$0	$0	$0	$0	$0
Anaerobic Digesters A&B (2 New Units)	$12,504,329	LS	1	$0	$0	$0	$0	$0
Anaerobic Digester C (Rehab)	$5,926,229	LS	1	$0	$0	$0	$0	$0
Thickening and Dewatering Building	$8,570,380	LS	1	$0	$0	$0	$0	$0
Thickeners	$3,791,444	LS	1	$0	$0	$0	$0	$0
Belt Filter Press	$5,687,166	LS	1	$0	$0	$0	$0	$0
Filtrate P.S.	$337,632	LS	1	$0	$0	$0	$0	$0
Filtrate Pumps	$309,462	LS	1	$0	$0	$0	$0	$0
Sludge Storage Tanks	$1,482,581	LS	1	$0	$0	$0	$0	$0
Gas Handling Boiler Facility	$4,597,912	LS	1	$0	$0	$0	$0	$0
Sludge Pad Modifications	$267,301	LS	1	$0	$0	$0	$0	$0
Generators	$11,468,570	LS	1	$0	$0	$0	$0	$0
Instrumentation & Control	$2,004,761	LS	1	$0	$0	$0	$0	$0
Total Present Value of Replacement Costs (Years 1 to 5):				**$0**	**$0**	**$0**	**$0**	**$0**

Table 5.2.1.4. Replacement Costs (Years 6 to 10)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Densification with Anaerobic Sludge Digestion (Preferred Alternative)

Current Inflation Rate based on Construction Cost Index: 2.97% EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of Replacement Costs in Year: 6	7	8	9	10
Yard Piping	$38,150,523	LS	1	$0	$0	$0	$0	$0
Sitework	$11,413,690	LS	1	$0	$0	$0	$0	$0
Maintenance Building	$400,952	LS	1	$0	$0	$0	$0	$0
Administration Building	$1,435,482	LS	1	$0	$0	$0	$0	$0
Headworks Structures	$5,498,000	LS	1	$0	$0	$0	$0	$0
Headworks Equipment	$5,559,925	LS	1	$0	$0	$0	$0	$0
Primary Clarifiers	$2,535,000	LS	1	$0	$0	$0	$0	$0
Primary Clarifier Equipment	$2,021,275	LS	1	$0	$0	$0	$0	$0
Primary Sludge P.S. Structure	$1,092,673	LS	1	$0	$0	$0	$0	$0
Primary Sludge Pumps	$1,001,507	LS	1	$0	$0	$0	$0	$0
Step Feed Dist. Box	$997,261	LS	1	$0	$0	$0	$0	$0
Aeration Basins	$35,183,313	LS	1	$0	$0	$0	$0	$0
Blowers/Diffusers	$9,213,572	LS	1	$0	$0	$0	$0	$0
Secondary Clarifiers	$4,907,076	LS	1	$0	$0	$0	$0	$0
Secondary Clarifier Equipment	$3,912,643	LS	1	$0	$0	$0	$0	$0
RAS/WAS P.S.	$1,462,358	LS	1	$0	$0	$0	$0	$0
Pumps	$1,340,348	LS	1	$0	$0	$0	$0	$0
Filters	$10,108,209	LS	1	$0	$0	$0	$0	$0
Filter Structures	$6,578,336	LS	1	$0	$0	$0	$0	$0
BWW/EQ	$1,281,900	LS	1	$0	$0	$0	$0	$0
EQ Meter Vault	$221,841	LS	1	$0	$0	$0	$0	$0
UV Disinfection Structure	$4,879,642	LS	1	$0	$0	$0	$0	$0
UV Disinfection Equipment	$5,720,266	LS	1	$0	$0	$0	$0	$0
Odor Control	$3,359,698	LS	1	$0	$0	$0	$0	$2,797,806
Anaerobic Digesters A&B (2 New Units)	$12,504,329	LS	1	$0	$0	$0	$0	$0
Anaerobic Digester C (Rehab)	$5,926,229	LS	1	$0	$0	$0	$0	$0
Thickening and Dewatering Building	$8,570,380	LS	1	$0	$0	$0	$0	$0
Thickeners	$3,791,444	LS	1	$0	$0	$0	$0	$0
Belt Filter Press	$5,687,166	LS	1	$0	$0	$0	$0	$0
Filtrate P.S.	$337,632	LS	1	$0	$0	$0	$0	$0
Filtrate Pumps	$309,462	LS	1	$0	$0	$0	$0	$0
Sludge Storage Tanks	$1,482,581	LS	1	$0	$0	$0	$0	$0
Gas Handling Boiler Facility	$4,597,912	LS	1	$0	$0	$0	$0	$0
Sludge Pad Modifications	$267,301	LS	1	$0	$0	$0	$0	$0
Generators	$11,468,570	LS	1	$0	$0	$0	$0	$0
Instrumentation & Control	$2,004,761	LS	1	$0	$0	$0	$0	$0
Total Present Value of Replacement Costs (Years 6 to 10):				**$0**	**$0**	**$0**	**$0**	**$2,797,806**

Table 5.2.1.5. Replacement Costs (Years 11 to 15)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Densification with Anaerobic Sludge Digestion (Preferred Alternative)

Current Inflation Rate based on Construction Cost Index: 2.97% EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of Replacement Costs in Year: 11	12	13	14	15
Yard Piping	$38,150,523	LS	1	$0	$0	$0	$0	$0
Sitework	$11,413,690	LS	1	$0	$0	$0	$0	$0
Maintenance Building	$400,952	LS	1	$0	$0	$0	$0	$0
Administration Building	$1,435,482	LS	1	$0	$0	$0	$0	$0
Headworks Structures	$5,498,000	LS	1	$0	$0	$0	$0	$0
Headworks Equipment	$5,559,925	LS	1	$0	$0	$0	$0	$0
Primary Clarifiers	$2,535,000	LS	1	$0	$0	$0	$0	$0
Primary Clarifier Equipment	$2,021,275	LS	1	$0	$0	$0	$0	$0
Primary Sludge P.S. Structure	$1,092,673	LS	1	$0	$0	$0	$0	$0
Primary Sludge Pumps	$1,001,507	LS	1	$0	$0	$0	$0	$0
Step Feed Dist. Box	$997,261	LS	1	$0	$0	$0	$0	$0
Aeration Basins	$35,183,313	LS	1	$0	$0	$0	$0	$0
Blowers/Diffusers	$9,213,572	LS	1	$0	$0	$0	$0	$0
Secondary Clarifiers	$4,907,076	LS	1	$0	$0	$0	$0	$0
Secondary Clarifier Equipment	$3,912,643	LS	1	$0	$0	$0	$0	$0
RAS/WAS P.S.	$1,462,358	LS	1	$0	$0	$0	$0	$0
Pumps	$1,340,348	LS	1	$0	$0	$0	$0	$0
Filters	$10,108,209	LS	1	$0	$0	$0	$0	$7,681,575
Filter Structures	$6,578,336	LS	1	$0	$0	$0	$0	$0
BWW/EQ	$1,281,900	LS	1	$0	$0	$0	$0	$0
EQ Meter Vault	$221,841	LS	1	$0	$0	$0	$0	$0
UV Disinfection Structure	$4,879,642	LS	1	$0	$0	$0	$0	$0
UV Disinfection Equipment	$5,720,266	LS	1	$0	$0	$0	$0	$0
Odor Control	$3,359,698	LS	1	$0	$0	$0	$0	$0
Anaerobic Digesters A&B (2 New Units)	$12,504,329	LS	1	$0	$0	$0	$0	$0
Anaerobic Digester C (Rehab)	$5,926,229	LS	1	$0	$0	$0	$0	$0
Thickening and Dewatering Building	$8,570,380	LS	1	$0	$0	$0	$0	$0
Thickeners	$3,791,444	LS	1	$0	$0	$0	$0	$0
Belt Filter Press	$5,687,166	LS	1	$0	$0	$0	$0	$0
Filtrate P.S.	$337,632	LS	1	$0	$0	$0	$0	$0
Filtrate Pumps	$309,462	LS	1	$0	$0	$0	$0	$0
Sludge Storage Tanks	$1,482,581	LS	1	$0	$0	$0	$0	$0
Gas Handling Boiler Facility	$4,597,912	LS	1	$0	$0	$0	$0	$0
Sludge Pad Modifications	$267,301	LS	1	$0	$0	$0	$0	$0
Generators	$11,468,570	LS	1	$0	$0	$0	$0	$0
Instrumentation & Control	$2,004,761	LS	1	$0	$0	$0	$0	$0
Total Present Value of Replacement Costs (Years 11 to 15):				**$0**	**$0**	**$0**	**$0**	**$7,681,575**

Table 5.2.1.6. Replacement Costs (Years 16 to 20)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Densification with Anaerobic Sludge Digestion (Preferred Alternative)

Current Inflation Rate based on Construction Cost Index: 2.97% EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of Replacement Costs in Year: 16	17	18	19	20
Yard Piping	$38,150,523	LS	1	$0	$0	$0	$0	$0
Sitework	$11,413,690	LS	1	$0	$0	$0	$0	$0
Maintenance Building	$400,952	LS	1	$0	$0	$0	$0	$0
Administration Building	$1,435,482	LS	1	$0	$0	$0	$0	$0
Headworks Structures	$5,498,000	LS	1	$0	$0	$0	$0	$0
Headworks Equipment	$5,559,925	LS	1	$0	$0	$0	$0	$0
Primary Clarifiers	$2,535,000	LS	1	$0	$0	$0	$0	$0
Primary Clarifier Equipment	$2,021,275	LS	1	$0	$0	$0	$0	$0
Primary Sludge P.S. Structure	$1,092,673	LS	1	$0	$0	$0	$0	$0
Primary Sludge Pumps	$1,001,507	LS	1	$0	$0	$0	$0	$694,526
Step Feed Dist. Box	$997,261	LS	1	$0	$0	$0	$0	$0
Aeration Basins	$35,183,313	LS	1	$0	$0	$0	$0	$0
Blowers/Diffusers	$9,213,572	LS	1	$0	$0	$0	$0	$0
Secondary Clarifiers	$4,907,076	LS	1	$0	$0	$0	$0	$0
Secondary Clarifier Equipment	$3,912,643	LS	1	$0	$0	$0	$0	$0
RAS/WAS P.S.	$1,462,358	LS	1	$0	$0	$0	$0	$0
Pumps	$1,340,348	LS	1	$0	$0	$0	$0	$929,506
Filters	$10,108,209	LS	1	$0	$0	$0	$0	$0
Filter Structures	$6,578,336	LS	1	$0	$0	$0	$0	$0
BWW/EQ	$1,281,900	LS	1	$0	$0	$0	$0	$0
EQ Meter Vault	$221,841	LS	1	$0	$0	$0	$0	$0
UV Disinfection Structure	$4,879,642	LS	1	$0	$0	$0	$0	$0
UV Disinfection Equipment	$5,720,266	LS	1	$0	$0	$0	$0	$0
Odor Control	$3,359,698	LS	1	$0	$0	$0	$0	$0
Anaerobic Digesters A&B (2 New Units)	$12,504,329	LS	1	$0	$0	$0	$0	$0
Anaerobic Digester C (Rehab)	$5,926,229	LS	1	$0	$0	$0	$0	$4,109,728
Thickening and Dewatering Building	$8,570,380	LS	1	$0	$0	$0	$0	$0
Thickeners	$3,791,444	LS	1	$0	$0	$0	$0	$0
Belt Filter Press	$5,687,166	LS	1	$0	$0	$0	$0	$0
Filtrate P.S.	$337,632	LS	1	$0	$0	$0	$0	$0
Filtrate Pumps	$309,462	LS	1	$0	$0	$0	$0	$214,606
Sludge Storage Tanks	$1,482,581	LS	1	$0	$0	$0	$0	$0
Gas Handling Boiler Facility	$4,597,912	LS	1	$0	$0	$0	$0	$0
Sludge Pad Modifications	$267,301	LS	1	$0	$0	$0	$0	$0
Generators	$11,468,570	LS	1	$0	$0	$0	$0	$7,953,238
Instrumentation & Control	$2,004,761	LS	1	$0	$0	$0	$0	$0
Total Present Value of Replacement Costs (Years 16 to 20):				**$0**	**$0**	**$0**	**$0**	**$13,901,604**
Total Present Value of Replacement Costs (Life of Project):								**$24,380,985**

Table 5.2.1.7. Present Value of Operations and Maintenance Costs (Years 1-10)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Densification with Anaerobic Sludge Digestion (Preferred Alternative)

Current Inflation Rate Based on Municipal Cost Index: 0.09%

EPA Discount Rate: 4.875%

				Present Value of O&M Costs for Year:									
Component	**Unit Cost**	**Unit**	**Quantity**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Headworks Equipment	$55,599	LS	1	$53,061	$50,638	$48,326	$46,119	$44,014	$42,004	$40,086	$38,256	$36,509	$34,842
Clarifier Equipment	$59,339	LS	1	$56,630	$54,044	$51,577	$49,222	$46,974	$44,829	$42,783	$40,829	$38,965	$37,186
Aeration Equipment	$92,136	LS	1	$87,929	$83,914	$80,083	$76,426	$72,937	$69,606	$66,428	$63,395	$60,501	$57,738
Pumps	$26,513	LS	1	$25,303	$24,147	$23,045	$21,993	$20,988	$20,030	$19,116	$18,243	$17,410	$16,615
Filter Equipment	$101,082	LS	1	$96,467	$92,062	$87,859	$83,847	$80,019	$76,365	$72,878	$69,551	$66,375	$63,345
UV Equipment	$57,203	LS	1	$54,591	$52,098	$49,720	$47,449	$45,283	$43,215	$41,242	$39,359	$37,562	$35,847
Odor Control Equipment	$33,597	LS	1	$32,063	$30,599	$29,202	$27,869	$26,596	$25,382	$24,223	$23,117	$22,061	$21,054
Digester Equipment	$36,861	LS	1	$35,178	$33,572	$32,039	$30,576	$29,180	$27,848	$26,576	$25,363	$24,205	$23,100
Thickeners	$37,914	LS	1	$36,183	$34,531	$32,955	$31,450	$30,014	$28,643	$27,336	$26,088	$24,896	$23,760
Dewatering Equipment	$56,872	LS	1	$54,275	$51,797	$49,432	$47,175	$45,021	$42,965	$41,003	$39,131	$37,345	$35,639
Gas Handling Boiler	$45,979	LS	1	$43,880	$41,876	$39,964	$38,139	$36,398	$34,736	$33,150	$31,637	$30,192	$28,814
Generators	$114,686	LS	1	$109,449	$104,452	$99,683	$95,131	$90,788	$86,642	$82,686	$78,911	$75,308	$71,870
Electricity	$885,649	LS	1	$845,211	$806,620	$769,790	$734,642	$701,099	$669,088	$638,538	$609,383	$581,559	$555,006
Total Present Value of Yearly O&M Expenses (Years 1-10):				**$1,530,219**	**$1,460,351**	**$1,393,673**	**$1,330,039**	**$1,269,311**	**$1,211,355**	**$1,156,046**	**$1,103,262**	**$1,052,888**	**$1,004,814**

Table 5.2.1.8. Present Value of Operations and Maintenance Costs (Years 11-20)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Densification with Anaerobic Sludge Digestion (Preferred Alternative)

Current Inflation Rate Based on Municipal Cost Index: 0.09% EPA Discount Rate: 4.875%

				Present Value of O&M Costs for Year:									
Component	**Unit Cost**	**Unit**	**Quantity**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Headworks Equipment	$55,599	LS	1	$33,251	$31,733	$30,284	$28,901	$27,582	$26,322	$25,121	$23,974	$22,879	$21,834
Clarifier Equipment	$59,339	LS	1	$35,488	$33,868	$32,321	$30,845	$29,437	$28,093	$26,810	$25,586	$24,418	$23,303
Aeration Equipment	$92,136	LS	1	$55,102	$52,586	$50,185	$47,894	$45,707	$43,620	$41,628	$39,728	$37,914	$36,183
Pumps	$26,513	LS	1	$15,856	$15,132	$14,441	$13,782	$13,153	$12,552	$11,979	$11,432	$10,910	$10,412
Filter Equipment	$101,082	LS	1	$60,452	$57,692	$55,058	$52,544	$50,145	$47,855	$45,670	$43,585	$41,595	$39,696
UV Equipment	$57,203	LS	1	$34,210	$32,648	$31,157	$29,735	$28,377	$27,082	$25,845	$24,665	$23,539	$22,464
Odor Control Equipment	$33,597	LS	1	$20,093	$19,175	$18,300	$17,464	$16,667	$15,906	$15,180	$14,487	$13,825	$13,194
Digester Equipment	$36,861	LS	1	$22,045	$21,038	$20,078	$19,161	$18,286	$17,451	$16,654	$15,894	$15,168	$14,476
Thickeners	$37,914	LS	1	$22,675	$21,640	$20,651	$19,709	$18,809	$17,950	$17,130	$16,348	$15,602	$14,889
Dewatering Equipment	$56,872	LS	1	$34,012	$32,459	$30,977	$29,563	$28,213	$26,925	$25,695	$24,522	$23,403	$22,334
Gas Handling Boiler	$45,979	LS	1	$27,498	$26,242	$25,044	$23,901	$22,809	$21,768	$20,774	$19,826	$18,920	$18,056
Generators	$114,686	LS	1	$68,588	$65,456	$62,468	$59,615	$56,893	$54,296	$51,817	$49,451	$47,193	$45,038
Electricity	$885,649	LS	1	$529,665	$505,481	$482,401	$460,375	$439,355	$419,294	$400,149	$381,879	$364,443	$347,803
Total Present Value of Yearly O&M Expenses (Years 11-20):				**$958,935**	**$915,151**	**$873,366**	**$833,489**	**$795,433**	**$759,114**	**$724,453**	**$691,376**	**$659,808**	**$629,682**
												Total Present Value of Annual O&M Costs (Life of Project):	**$20,352,763**

Table 5.2.1.9. Present Value of Intermittent Operations and Maintenance Costs (Years 1-10)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Densification with Anaerobic Sludge Digestion (Preferred Alternative)

Current Inflation Rate Based on Municipal Cost Index: 0.09% EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of O&M Costs for Year: 1	2	3	4	5	6	7	8	9	10
Miscellaneous Pump Refurbishment	$500,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Miscellaneous Process Concrete Tank Painting	$1,000,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Digester Coating	$460,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$288,266
Digester Cleaning	$150,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$94,000
Chemical Storage Tank Replacement	$250,000	LS	1	$0	$0	$0	$0	$0	$188,869	$0	$0	$0	$0
Aeration Diffuser Replacement	$5,000	LS	1	$0	$0	$0	$0	$0	$3,777	$0	$0	$0	$0
Total Present Value of Intermittent Operations & Maintenance Costs (Years 1-10):				**$0**	**$0**	**$0**	**$0**	**$0**	**$192,647**	**$0**	**$0**	**$0**	**$382,266**

Table 5.2.1.10. Present Value of Intermittent Operations and Maintenance Costs (Years 11-20)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
Densification with Anaerobic Sludge Digestion (Preferred Alternative)

Current Inflation Rate Based on Municipal Cost Index: 0.09% EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of O&M Costs for Year: 11	12	13	14	15	16	17	18	19	20
Miscellaneous Pump Refurbishment	$500,000	LS	1	$299,026	$0	$0	$0	$0	$0	$0	$0	$0	$0
Miscellaneous Process Concrete Tank Painting	$1,000,000	LS	1	$0	$0	$0	$0	$0	$473,431	$0	$0	$0	$392,709
Digester Coating	$460,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Digester Cleaning	$150,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Chemical Storage Tank Replacement	$250,000	LS	1	$149,513	$0	$0	$0	$0	$0	$0	$0	$0	$0
Aeration Diffuser Replacement	$5,000	LS	1	$2,990	$0	$0	$0	$0	$2,367	$0	$0	$0	$0
Total Present Value of Intermittent Operations & Maintenance Costs (Years 11-20):				**$451,529**	**$0**	**$0**	**$0**	**$0**	**$475,798**	**$0**	**$0**	**$0**	**$392,709**
Total Present Value of Intermittent Operations & Maintenance Costs (Life of Project):													**$1,894,949**

Table 5.2.2.1. Capital Costs
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority

Complete the areas shown in gray below. Where shown, use pulldown menus to select options. The spreadsheet will calculate the capital costs.

Alternative:	**BioDenipho & Thermal Sludge Drying**			
Project Administration ($):	$11,248,517			
Component	**Unit Cost[a]**	**Unit**	**Quantity**	**Total Cost**
Yard Piping	$26,905,931	LS	1	$26,905,931
Sitework	$6,726,483	LS	1	$6,726,483
Maintenance Building	$400,952	LS	1	$400,952
Administration Building	$1,435,482	LS	1	$1,435,482
Headworks Structures	$5,498,000	LS	1	$5,498,000
Headworks Equipment	$5,559,925	LS	1	$5,559,925
Biodenipho System Equipment (including secondary clarifier equipment, tertiary filtration equipment)	$70,887,304	LS	1	$70,887,304
Oxidation Ditches, Clarifiers, Filters Structures	$109,868,883	LS	1	$109,868,883
RAS/WAS P.S.	$2,924,717	LS	1	$2,924,717
Pumps	$2,680,696	LS	1	$2,680,696
UV Disinfection Structure	$4,879,642	LS	1	$4,879,642
UV Disinfection Equipment	$5,720,266	LS	1	$5,720,266
Odor Control	$3,359,698	LS	1	$3,359,698
Thickening and Dewatering Building	$8,570,380	LS	1	$8,570,380
Thickeners	$3,791,444	LS	1	$3,791,444
Belt Filter Press	$5,687,166	LS	1	$5,687,166
Filtrate P.S.	$337,632	LS	1	$337,632
Filtrate Pumps	$309,462	LS	1	$309,462
Thermal Dryer Facility	$21,856,460	LS	1	$21,856,460
Dryers	$10,791,200	LS	1	$10,791,200
Cake Storage Silos	$3,000,000	LS	1	$3,000,000
Dry Pellets Storage Silos	$1,500,000	LS	1	$1,500,000
Generator	$7,473,859	LS	1	$7,473,859
Instrumentation & Control	$5,568,000	LS	1	$5,568,000
			Total Construction Cost:	**$315,733,583**
			Construction Contingency Cost:	**$31,573,358**
			Project Administration Cost:	**$11,248,517**
			SRF Loan Fee Cost:	**$1,400,000**
			Total Capital Cost:	**$359,955,458**

[a]Unit costs are in today's dollars, not future dollars.

Table 5.2.2.2. Project Cost Life Cycle Assumptions Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project Cape Fear Public Utility Authority BioDenipho & Thermal Sludge Drying			
Complete the areas shown in gray.			
Component	**Expected Life Cycle**	**Replacement Expected? †**	**Rationale for Expected Life Cycle**
Yard Piping	40	N	Engineering Judgement
Sitework	N/A	N/A	Engineering Judgement
Maintenance Building	30	N	Engineering Judgement
Administration Building	30	N	Engineering Judgement
Headworks Structures	30	N	Engineering Judgement
Headworks Equipment	25	N	Engineering Judgement
BioDenipho System Equipment (including secondary clarifier equipment, tertiary filtration equipment)	25	N	Engineering Judgement
Oxidation Ditches, Clarifiers, Filters Structures	30	N	Engineering Judgement
RAS/WAS P.S.	30	N	Engineering Judgement
Pumps	20	Y	Engineering Judgement
UV Disinfection Structure	30	N	Engineering Judgement
UV Disinfection Equipment	25	N	Engineering Judgement
Odor Control	10	Y	Engineering Judgement
Thickening and Dewatering Building	40	N	Engineering Judgement
Thickeners	25	N	Engineering Judgement
Belt Filter Press	25	N	Engineering Judgement
Filtrate P.S.	40	N	Engineering Judgement
Filtrate Pumps	20	Y	Engineering Judgement
Thermal Dryer Facility	50	N	Engineering Judgement
Dryers	20	Y	Engineering Judgement
Cake Storage Silos	50	N	Engineering Judgement
Dry Pellets Storage Silos	50	N	Engineering Judgement
Generator	20	Y	Engineering Judgement
Instrumentation & Control	40	N	Engineering Judgement

Table 5.2.2.3. Replacement Costs (Years 1 to 5)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
BioDenipho & Thermal Sludge Drying

Current Inflation Rate based on Construction Cost Index: 2.97% EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of Replacement Costs in Year: 1	2	3	4	5
Yard Piping	$27,658,131	LS	1	$0	$0	$0	$0	$0
Sitework	$6,914,533	LS	1	$0	$0	$0	$0	$0
Maintenance Building	$400,952	LS	1	$0	$0	$0	$0	$0
Administration Building	$1,435,482	LS	1	$0	$0	$0	$0	$0
Headworks Structures	$5,498,000	LS	1	$0	$0	$0	$0	$0
Headworks Equipment	$5,559,925	LS	1	$0	$0	$0	$0	$0
BioDenipho System Equipment (including secondary clarifier equipment, tertiary filtration equipment)	$70,887,304	LS	1	$0	$0	$0	$0	$0
Oxidation Ditches, Clarifiers, Filters Structures	$109,868,883	LS	1	$0	$0	$0	$0	$0
UV Disinfection Structure	$4,879,642	LS	1	$0	$0	$0	$0	$0
UV Disinfection Equipment	$5,720,266	LS	1	$0	$0	$0	$0	$0
Odor Control	$3,359,698	LS	1	$0	$0	$0	$0	$0
Thickening and Dewatering Building	$8,570,380	LS	1	$0	$0	$0	$0	$0
Thickeners	$3,791,444	LS	1	$0	$0	$0	$0	$0
Belt Filter Press	$5,687,166	LS	1	$0	$0	$0	$0	$0
Filtrate P.S.	$337,632	LS	1	$0	$0	$0	$0	$0
Filtrate Pumps	$309,462	LS	1	$0	$0	$0	$0	$0
Thermal Dryer Facility	$21,856,460	LS	1	$0	$0	$0	$0	$0
Dryers	$10,791,200	LS	1	$0	$0	$0	$0	$0
Cake Storage Silos	$3,000,000	LS	1	$0	$0	$0	$0	$0
Dry Pellets Storage Silos	$1,500,000	LS	1	$0	$0	$0	$0	$0
Generator	$7,473,859	LS	1	$0	$0	$0	$0	$0
Instrumentation & Control	$5,568,000	LS	1	$0	$0	$0	$0	$0
Total Present Value of Replacement Costs (Years 1 to 5):				**$0**	**$0**	**$0**	**$0**	**$0**

Table 5.2.2.4. Replacement Costs (Years 6 to 10)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
BioDenipho & Thermal Sludge Drying

Current Inflation Rate based on Construction Cost Index: 2.97%

EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of Replacement Costs in Year: 6	7	8	9	10
Yard Piping	$27,658,131	LS	1	$0	$0	$0	$0	$0
Sitework	$6,914,533	LS	1	$0	$0	$0	$0	$0
Maintenance Building	$400,952	LS	1	$0	$0	$0	$0	$0
Administration Building	$1,435,482	LS	1	$0	$0	$0	$0	$0
Headworks Structures	$5,498,000	LS	1	$0	$0	$0	$0	$0
Headworks Equipment	$5,559,925	LS	1	$0	$0	$0	$0	$0
BioDenipho System Equipment (including secondary clarifier equipment, tertiary filtration equipment)	$70,887,304	LS	1	$0	$0	$0	$0	$0
Oxidation Ditches, Clarifiers, Filters Structures	$109,868,883	LS	1	$0	$0	$0	$0	$0
UV Disinfection Structure	$4,879,642	LS	1	$0	$0	$0	$0	$0
UV Disinfection Equipment	$5,720,266	LS	1	$0	$0	$0	$0	$0
Odor Control	$3,359,698	LS	1	$0	$0	$0	$0	$2,797,806
Thickening and Dewatering Building	$8,570,380	LS	1	$0	$0	$0	$0	$0
Thickeners	$3,791,444	LS	1	$0	$0	$0	$0	$0
Belt Filter Press	$5,687,166	LS	1	$0	$0	$0	$0	$0
Filtrate P.S.	$337,632	LS	1	$0	$0	$0	$0	$0
Filtrate Pumps	$309,462	LS	1	$0	$0	$0	$0	$0
Thermal Dryer Facility	$21,856,460	LS	1	$0	$0	$0	$0	$0
Dryers	$10,791,200	LS	1	$0	$0	$0	$0	$0
Cake Storage Silos	$3,000,000	LS	1	$0	$0	$0	$0	$0
Dry Pellets Storage Silos	$1,500,000	LS	1	$0	$0	$0	$0	$0
Generator	$7,473,859	LS	1	$0	$0	$0	$0	$0
Instrumentation & Control	$5,568,000	LS	1	$0	$0	$0	$0	$2,797,806
Total Present Value of Replacement Costs (Years 6 to 10):				**$0**	**$0**	**$0**	**$0**	**$2,797,806**

Table 5.2.2.5. Replacement Costs (Years 11 to 15)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
BioDenipho & Thermal Sludge Drying

Current Inflation Rate based on Construction Cost Index: 2.97%

EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of Replacement Costs in Year: 11	12	13	14	15
Yard Piping	$27,658,131	LS	1	$0	$0	$0	$0	$0
Sitework	$6,914,533	LS	1	$0	$0	$0	$0	$0
Maintenance Building	$400,952	LS	1	$0	$0	$0	$0	$0
Administration Building	$1,435,482	LS	1	$0	$0	$0	$0	$0
Headworks Structures	$5,498,000	LS	1	$0	$0	$0	$0	$0
Headworks Equipment	$5,559,925	LS	1	$0	$0	$0	$0	$0
BioDenipho System Equipment (including secondary clarifier equipment, tertiary filtration equipment)	$70,887,304	LS	1	$0	$0	$0	$0	$0
Oxidation Ditches, Clarifiers, Filters Structures	$109,868,883	LS	1	$0	$0	$0	$0	$0
UV Disinfection Structure	$4,879,642	LS	1	$0	$0	$0	$0	$0
UV Disinfection Equipment	$5,720,266	LS	1	$0	$0	$0	$0	$0
Odor Control	$3,359,698	LS	1	$0	$0	$0	$0	$0
Thickening and Dewatering Building	$8,570,380	LS	1	$0	$0	$0	$0	$0
Thickeners	$3,791,444	LS	1	$0	$0	$0	$0	$0
Belt Filter Press	$5,687,166	LS	1	$0	$0	$0	$0	$0
Filtrate P.S.	$337,632	LS	1	$0	$0	$0	$0	$0
Filtrate Pumps	$309,462	LS	1	$0	$0	$0	$0	$5,679,642
Thermal Dryer Facility	$21,856,460	LS	1	$0	$0	$0	$0	$0
Dryers	$10,791,200	LS	1	$0	$0	$0	$0	$0
Cake Storage Silos	$3,000,000	LS	1	$0	$0	$0	$0	$0
Dry Pellets Storage Silos	$1,500,000	LS	1	$0	$0	$0	$0	$0
Generator	$7,473,859	LS	1	$0	$0	$0	$0	$0
Instrumentation & Control	$5,568,000	LS	1	$0	$0	$0	$0	$0
Total Present Value of Replacement Costs (Years 11 to 15):				**$0**	**$0**	**$0**	**$0**	**$5.679.642**

Table 5.2.2.6. Replacement Costs (Years 16 to 20)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
BioDenipho & Thermal Sludge Drying

Current Inflation Rate based on Construction Cost Index: 2.97%

EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of Replacement Costs in Year: 16	17	18	19	20
Yard Piping	$27,658,131	LS	1	$0	$0	$0	$0	$0
Sitework	$6,914,533	LS	1	$0	$0	$0	$0	$0
Maintenance Building	$400,952	LS	1	$0	$0	$0	$0	$0
Administration Building	$1,435,482	LS	1	$0	$0	$0	$0	$0
Headworks Structures	$5,498,000	LS	1	$0	$0	$0	$0	$0
Headworks Equipment	$5,559,925	LS	1	$0	$0	$0	$0	$0
BioDenipho System Equipment (including secondary clarifier equipment, tertiary filtration equipment)	$70,887,304	LS	1	$0	$0	$0	$0	$0
Oxidation Ditches, Clarifiers, Filters Structures	$109,868,883	LS	1	$0	$0	$0	$0	$0
UV Disinfection Structure	$4,879,642	LS	1	$0	$0	$0	$0	$0
UV Disinfection Equipment	$5,720,266	LS	1	$0	$0	$0	$0	$0
Odor Control	$3,359,698	LS	1	$0	$0	$0	$0	$0
Thickening and Dewatering Building	$8,570,380	LS	1	$0	$0	$0	$0	$0
Thickeners	$3,791,444	LS	1	$0	$0	$0	$0	$0
Belt Filter Press	$5,687,166	LS	1	$0	$0	$0	$0	$0
Filtrate P.S.	$337,632	LS	1	$0	$0	$0	$0	$0
Filtrate Pumps	$309,462	LS	1	$0	$0	$0	$0	$214,606
Thermal Dryer Facility	$21,856,460	LS	1	$0	$0	$0	$0	$0
Dryers	$10,791,200	LS	1	$0	$0	$0	$0	$7,483,495
Cake Storage Silos	$3,000,000	LS	1	$0	$0	$0	$0	$0
Dry Pellets Storage Silos	$1,500,000	LS	1	$0	$0	$0	$0	$0
Generator	$7,473,859	LS	1	$0	$0	$0	$0	$0
Instrumentation & Control	$5,568,000	LS	1	$0	$0	$0	$0	$0
Total Present Value of Replacement Costs (Years 16 to 20):				**$0**	**$0**	**$0**	**$0**	**$7,698,101**
Total Present Value of Replacement Costs (Life of Project):								**$16,175,548**

Table 5.2.2.7. Present Value of Operations and Maintenance Costs (Years 1-10)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
BioDenipho & Thermal Sludge Drying

Current Inflation Rate Based on Municipal Cost Index: 0.09% EPA Discount Rate: 4.875%

				Present Value of O&M Costs for Year:									
Component	**Unit Cost**	**Unit**	**Quantity**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Headworks Equipment	$55,599	LS	1	$53,061	$50,638	$48,326	$46,119	$44,014	$42,004	$40,086	$38,256	$36,509	$34,842
BioDenipho System Equipment	$708,873	LS	1	$676,507	$645,618	$616,140	$588,007	$561,159	$535,537	$511,085	$487,750	$465,479	$444,226
Pumps	$53,322	LS	1	$50,887	$48,564	$46,346	$44,230	$42,211	$40,283	$38,444	$36,689	$35,013	$33,415
UV Equipment	$57,203	LS	1	$54,591	$52,098	$49,720	$47,449	$45,283	$43,215	$41,242	$39,359	$37,562	$35,847
Odor Control Equipment	$33,597	LS	1	$32,063	$30,599	$29,202	$27,869	$26,596	$25,382	$24,223	$23,117	$22,061	$21,054
Thickeners	$37,914	LS	1	$36,183	$34,531	$32,955	$31,450	$30,014	$28,643	$27,336	$26,088	$24,896	$23,760
Dewatering Equipment	$56,872	LS	1	$54,275	$51,797	$49,432	$47,175	$45,021	$42,965	$41,003	$39,131	$37,345	$35,639
Dryers	$107,912	LS	1	$102,985	$98,283	$93,795	$89,513	$85,425	$81,525	$77,803	$74,250	$70,860	$67,625
Generators	$74,739	LS	1	$71,326	$68,069	$64,961	$61,995	$59,165	$56,463	$53,885	$51,425	$49,077	$46,836
Electricity	$1,027,446	LS	1	$980,534	$935,763	$893,037	$852,262	$813,349	$776,212	$740,771	$706,948	$674,669	$643,865
Total Present Value of Yearly O&M Expenses (Years 1-10):				**$2,112,411**	**$2,015,960**	**$1,923,913**	**$1,836,069**	**$1,752,236**	**$1,672,231**	**$1,595,878**	**$1,523,012**	**$1,453,472**	**$1,387,108**

Table 5.2.2.8. Present Value of Operations and Maintenance Costs (Years 11-20)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
BioDenipho & Thermal Sludge Drying

Current Inflation Rate Based on Municipal Cost Index: 0.09% EPA Discount Rate: 4.875%

				Present Value of O&M Costs for Year:									
Component	**Unit Cost**	**Unit**	**Quantity**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Headworks Equipment	$55,599	LS	1	$33,251	$31,733	$30,284	$28,901	$27,582	$26,322	$25,121	$23,974	$22,879	$21,834
BioDenipho System Equipment	$708,873	LS	1	$423,943	$404,586	$386,113	$368,484	$351,659	$335,603	$320,279	$305,656	$291,700	$278,381
Pumps	$53,322	LS	1	$31,889	$30,433	$29,044	$27,717	$26,452	$25,244	$24,091	$22,991	$21,942	$20,940
UV Equipment	$57,203	LS	1	$34,210	$32,648	$31,157	$29,735	$28,377	$27,082	$25,845	$24,665	$23,539	$22,464
Odor Control Equipment	$33,597	LS	1	$20,093	$19,175	$18,300	$17,464	$16,667	$15,906	$15,180	$14,487	$13,825	$13,194
Thickeners	$37,914	LS	1	$22,675	$21,640	$20,651	$19,709	$18,809	$17,950	$17,130	$16,348	$15,602	$14,889
Dewatering Equipment	$56,872	LS	1	$34,012	$32,459	$30,977	$29,563	$28,213	$26,925	$25,695	$24,522	$23,403	$22,334
Dryers	$107,912	LS	1	$64,537	$61,590	$58,778	$56,094	$53,533	$51,089	$48,756	$46,530	$44,406	$42,378
Generators	$74,739	LS	1	$44,698	$42,657	$40,709	$38,850	$37,076	$35,384	$33,768	$32,226	$30,755	$29,351
Electricity	$1,027,446	LS	1	$614,466	$586,410	$559,635	$534,083	$509,697	$486,425	$464,215	$443,020	$422,792	$403,487
Total Present Value of Yearly O&M Expenses (Years 11-20):				**$1,323,774**	**$1,263,332**	**$1,205,649**	**$1,150,601**	**$1,098,065**	**$1,047,929**	**$1,000,081**	**$954,418**	**$910,840**	**$869,252**
												Total Present Value of Annual O&M Costs (Life of Project):	**$28,096,233**

Table 5.2.2.9. Present Value of Intermittent Operations and Maintenance Costs (Years 1-10)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
BioDenipho & Thermal Sludge Drying

Current Inflation Rate Based on Municipal Cost Index: 0.09% EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of O&M Costs for Year: 1	2	3	4	5	6	7	8	9	10
Miscellaneous Pump Refurbishment	$500,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Miscellaneous Process Concrete Tank Painting	$2,500,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Dryer Components Replacement	$500,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Chemical Storage Tank Replacement	$250,000	LS	1	$0	$0	$0	$0	$0	$188,869	$0	$0	$0	$0
Aeration Diffuser Replacement	$10,000	LS	1	$0	$0	$0	$0	$0	$7,555	$0	$0	$0	$0
Mixer Refurbishment	$20,000	LS	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Present Value of Intermittent Operations & Maintenance Costs (Years 1-10):				**$0**	**$0**	**$0**	**$0**	**$0**	**$196,424**	**$0**	**$0**	**$0**	**$0**

Table 5.2.2.10. Present Value of Intermittent Operations and Maintenance Costs (Years 11-20)
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project
Cape Fear Public Utility Authority
BioDenipho & Thermal Sludge Drying

Current Inflation Rate Based on Municipal Cost Index: 0.09% EPA Discount Rate: 4.875%

Component	Unit Cost	Unit	Quantity	Present Value of O&M Costs for Year: 11	12	13	14	15	16	17	18	19	20
Miscellaneous Pump Refurbishment	$500,000	LS	1	$299,026	$0	$0	$0	$0	$0	$0	$0	$0	$0
Miscellaneous Process Concrete Tank Painting	$2,500,000	LS	1	$0	$0	$0	$0	$0	$1,183,578	$0	$0	$0	$0
Dryer Components Replacement	$500,000	LS	1	$299,026	$0	$0	$0	$0	$0	$0	$0	$0	$0
Chemical Storage Tank Replacement	$250,000.00	LS	1	$149,513	$0	$0	$0	$0	$118,358	$0	$0	$0	$0
Aeration Diffuser Replacement	$10,000	LS	1	$5,981	$0	$0	$0	$0	$4,734	$0	$0	$0	$0
Mixer Refurbishment	$20,000	LS	1	$11,961	$0	$0	$0	$0	$9,469	$0	$0	$0	$0
Total Present Value of Intermittent Operations & Maintenance Costs (Years 11-20):				**$765,507**	**$0**	**$0**	**$0**	**$0**	**$1,316,139**	**$0**	**$0**	**$0**	**$0**
Total Present Value of Intermittent Operations & Maintenance Costs (Life of Project):													**$2,278,069**

Table 5.2.3. Total Present Worth for Feasible Alternatives						
Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project						
Cape Fear Public Utility Authority						
	Capital Costs	**Replacement Costs Present Worth**	**O&M Costs Present Worth**			**Total Present Worth**
			Annual	**Intermittent**	**Total**	
Densification with Anaerobic Sludge Digestion (Preferred)	$246,767,584	$24,380,985	$20,352,763	$1,894,949	$22,247,712	$293,396,281
BioDenipho & Thermal Sludge Drying	$359,955,458	$16,175,548	$28,096,233	$2,278,069	$30,374,302	$406,505,308

Section 6.0 Proposed Project Description

The proposed Southside Wastewater Treatment Plant Replacement and Capacity Upgrade project will replace and expand the existing CFPUA SSWWTP at 3436 River Rd, Wilmington, NC (New Hanover County). The existing treatment process is described in Section 2.0. The existing 12 MGD treatment plant will be expanded to 16 MGD (peaking factor 2.5, see Table 3.3) with provisions to expand to 20 and 24 MGD in the future. Figure 20 shows the preliminary site plan. A project location map is included in Figure 2. Approximately 25 acres of land (owned by CFPUA) will be disturbed. The proposed facilities include:

- Screenings and grit removal facility with flow measurement
- Primary clarifiers and primary sludge pumping
- Aeration basins and blower building
- Secondary clarifiers and return and waste activated sludge pumping
- Tertiary filters
- Ultraviolet disinfection facility
- Outfall
- Reclaimed water pump station
- Drain pump station
- Thickening and dewatering equipment and building
- Filtrate pump station
- Liquid sludge storage tanks
- Anaerobic digesters and digester control building
- Digester gas handling and utilization facilities
- Modifications to the existing cake storage with offsite cake solids receiving
- Septage/Vactor truck receiving station
- Odor control facilities
- Chemical storage and feed facilities
- Administration building with observation deck and laboratory
- Generators
- SCADA network

An expanded WWTP could support additional population growth and development which could negatively affect the environmental features discussed in Section 7.0. It is anticipated that existing permitting requirements, laws, and ordinances will mitigate potential impacts caused by such growth. It should be noted that in 2013, an Environmental Assessment was prepared per the State Environmental Protection Act (SEPA) guidelines for an expansion of the WWTP to 24 MGD. A Finding of No Significant Impact (FONSI) was issued in September 2013, and the permit to expand the facility up to 24 MGD was issued. Secondary and cumulative impacts were addressed as part of this assessment, and it was determined that expansion of the facility would not result in significant impacts to the environment. Subsequently, the facility was issued an NPDES permit for phased expansions to 16 MGD, 20 MGD, and 24 MGD.

It is anticipated that the following permits will be required:

- NCDEQ Authorization to Construct
- NCDEQ Sedimentation and Erosion Control Plan
- CAMA / NCDEQ 401 Water Quality Certification
- USACE 404 Water Quality Certification
- CAMA/USACE permitting will be determined during initial evaluation and final location of the outfall.
- Stormwater Management Permit (City of Wilmington and NCDEQ)
- Building Permits (New Hanover County)
- City of Wilmington Technical Review Committee (TRC) – Site Plan Review
- Encroachment Agreement for utilities and Driveway Permit for new driveways (DOT)

Environmental impacts of this alternative include minor, temporary, direct construction impacts to soils, topography, noise, and air as construction takes place. Mitigation is proposed to minimize these impacts, including reduction of the construction area to the greatest extent practical, utilization of silt fences to keep sedimentation onsite, restriction of construction to weekdays during daylight hours, and minimization of dust. No significant secondary and cumulative impacts are anticipated to occur. The existing local government and state requirements are anticipated to be sufficient to mitigate any impacts of the proposed project. The proposed project will also relocate the UV disinfection units out of the 100-year floodplain which will improve the overall resilience, reliability, and performance of the SSWWTP. This ultimately benefits both the environment and community the SSWWTP serves.

Capital costs for the proposed project are estimated at $246,767,584. The total present worth for the proposed project is estimated at $293,396,281.

Preliminary calculations and design criteria for each unit/component are described in Section 6.1 below.

6.1 Proposed Project Design Details

Screenings and Grit Removal Facility

The proposed screenings and grit removal facility will be similar to the facility at the NSWWTP. The facility will include mechanical bar screens, shaftless screw conveyors, stacked tray grit collectors, a grit pumping system, and grit washing systems.

Off-site pumps will convey raw wastewater to the SWWTP. Six force mains, including one future force main, will combine on site in a common header. Sample ports on the individual force mains will also be provided. From the common header, two parallel force mains will convey wastewater to the proposed screening and grit removal facility. The discharge will combine in a common channel for distribution to as many as three channels equipped with multi-rake mechanical bar screens. The number of screening channels in service will depend on the amount of influent flow that is received. A fourth channel with a manual bar rack will be available as a parallel flow path if necessary. The third screen channel will continue to be evaluated in detailed design and may be replaced with a second manual bar rack until buildout flows are realized.

Screened wastewater will discharge into a common channel and be distributed to stacked tray grit collection units. Up to three units will operate depending on the amount of flow. A bypass channel will be available to receive some or all the screened wastewater if required. Collected grit will be pumped to the grit washing and dewatering equipment.

Screened and de-gritted wastewater from each stacked tray unit will pass over an effluent weir and enter a common channel equipped with single drop diffusers intended to keep solids in suspension. A weir shelf was added to the original 2008 design to reduce the impacts from the single drop diffuser to the flow distribution. This shelf also provides easier access for future weir maintenance. The preliminary treated effluent will exit the screening and grit removal facility via one of three weirs. Two weirs distribute flow to a primary clarifier and one weir allows flow to bypass the primary clarifiers. The control setpoint triggering when flow is to be bypassed around the primary clarifiers will be coordinated in the detailed design.

The basis of design for the mechanical bar screens is listed below in Table 6.1.

Table 6.1. Mechanical Bar Screen Design Criteria

Design Parameter	Value
Number of Units	2
Channel width	4'-0"
Channel depth	6-’3”
Channel invert elevation	42.50
Operating floor elevation	48.75
Minimum screen discharge height over operating floor	6’-0” ±
Maximum Facility Design Flow Rate	60 MGD
Number of Units in Service Required	3
Flow rate per screen:	
Maximum (peak flow)	20 MGD
Average	12 MGD
Minimum	4 MGD
Maximum downstream water depth at peak flow	44.85 ±
Max. allowable head loss at peak flow (clean screen)	10.58
Max. allowable head loss at peak flow (30% blinded screen)	46.73
Height of bar rack (minimum vertical height from channel invert)	6’-0”
Clear opening between blades (bars)	0.25-inch
Minimum blade thickness	0.25-inch
Angle of Inclination	80°
Manufacturers	JWC and Huber

Each screen will discharge removed debris into a shaftless screw conveyor that will transport the debris to dumpsters. The basis of design for the shaftless screw conveyors is listed below in Table 6.2.

Table 6.2. Shaftless Screw Conveyor Design Criteria

Design Parameter	Value
Number of Units	3
Number of Screws/Unit:	1
Design Bed Loading Factor (DBLF)	30%
Volumetric Capacity at DBLF, cubic ft/hour	12.5
Mass Capacity at DBLF, lbs./hour	625
Minimum Diameter, inches	12
Nominal Length, feet	
Conveyor 1	6’-9”
Conveyor 2	18’-6”
Conveyor 3	30’-0”
Maximum Trough Segment Length, feet	12
Conveyor Style	Shaftless
Inclination / Slope	0° (Flat)
Screw Pitch	Full
Rotating Speed, rpm	< 20
Pressure Relief Cover(s)	Yes
Inlet Flanges	Yes
Discharge Chutes	No
Type of Flight:	Shaftless Flight
Screw Loading Type:	Push
Screw RPM (estimated):	10
Screw RPM (maximum):	15
Motor RPM (nominal):	1800
Motor HP (estimated, minimum):	3
Power Supply:	460 V/3 ph/60 Hz
Drive Type:	Constant Speed
Inlet Size (inch):	13 x 24 Longitudinal, Flanged
Number of Inlets:	1
Discharge Gate Size (inch):	13 x 13, Flange
Number of Discharge Gates:	1
Trough Type:	"U" Trough
Material Handled:	Uncompacted Screenings
Manufacturers	Custom Conveyor Corp., Jim Meyers & Sons, KWS Manufacturing, Spirac
Special Requirements (See notes below)	1, 2

1. Provide conveyor inlet connection to match mechanical bar screen discharge chutes.
2. Support locations and requirements shall be coordinated with the manufacturer in detailed design.

The basis of design for the stacked tray grit removal equipment is listed below in Table 6.3.

Table 6.3. Stacked Tray Grit Removal Design Criteria

Design Parameter	Value
Number of Units	3
Trays per Unit	8 current (12 buildout)
Tray Diameter (feet)	12
Surface Area/Unit (ft^2)	904 (1,356 buildout)
Max. Headloss at Peak Flows (inch)	12
Average Flow/Unit (mgd)	16 (24 MGD buildout)
Peak Flow/Unit (mgd)	40 (60 MGD buildout)
Performance at Average Flow	95% removal of all grit (specific gravity 2.65) ≥ 74 micron (200 mesh)
Performance at Peak Flow	95% removal of all grit (specific gravity 2.65) ≥ 105 micron (140 mesh)
Underflow Connection (in)	4
NPW Connection (in)	1
NPW Requirements	11 gpm @ 50 psig
Materials of Construction	316 stainless steel support structure and duct LPDE trays
Manufacturers	Hydro Intl or equal

Both the WEMCO Hydrogritter and the Hydro International GritCleanse are being evaluated for grit washing and dewatering. The decision to deviate from the 2008 basis of design was based on the performance of the Hydro International SlurryCup and Grit Snail at the Northside plant. The basis of design for the GritCleanse is listed below in Table 6.4.

Table 6.4. Grit Washing and Dewatering Equipment (Specific to GritCleanse) Design Criteria

Design Parameter	Value
Number of Units	3
Design Flow Rate (gpm)	300
Peak Hydraulic Capacity (gpm)	400
Performance at Average Flow	95% removal of all grit (specific gravity 2.65) ≥ 74 micron (200 mesh)
Volatile Content	≤ 5% Volatile Solids
Solids Content	90% total solids in washed grit
Minimum Conveyance Capacity (cy/hr)	1.5
Driving Head (inch)	4
Wash water	20 gpm continuously, plus 25 gpm intermittently
Manufacturers	Hydro Intl or equal
NPW Requirements	Will be coordinated during detailed design if equipment is selected
Control Operation	Intermittent feed from grit pumps will be coordinated during detailed design if equipment is selected

The basis of design for the Hydrogritter is listed below in Table 6.5 and Table 6.6.

Table 6.5. Grit Cyclone Design Criteria

Design Parameter	Value
Total Number of Units	3
Design Capacity (Feed rate), gpm	250
Max Underflow, gpm	24
Inlet Feed Pressure, psi	10
Inlet Connection Flange, inches	4
Overflow Connection Flange, inches	6
Vortex Finder, inches	4
Apex, inches	2
Manufacturers	WEMCO or equal

Table 6.6. Grit Classifier Design Criteria

Design Parameter	Value
Total Number of Units	3
Minimum Surface Area at Max Water Level, sf	8.3
Minimum Weir Length, ft.	2.4
Minimum Screw Diameter, inches	12
Max Screw Speed, rpm	12
Manufacturers	WEMCO or equal

The basis of design for horizontal recessed impeller grit pumps is listed below in Table 6.7. The TDH and power requirements for the grit pumps will be finalized in detailed design when a grit cleaning technology is selected.

Table 6.7. Grit Pump Design Criteria

Design Parameter	Value		
Number of Units	3		
Design Capacity (gpm)	150	250	350
Total Dynamic Head (feet)	45	43	41
Maximum Break Horsepower	8	9	11
Maximum Pump Speed (rpm)	1,400		
Suction Condition	Flooded		
Minimum Size of Solids (Spherical Diameter, inches)	4		
Minimum Suction Diameter (in)	4		
Minimum Discharge Diameter (in)	4		
Manufacturers	WEMCO Model “C” Series, Hayward-Gordon Model XR-4 Series, Goulds/Morris Pump Model 6100 Series		

The basis of design for the single drop air diffusers is listed below in Table 6.8. In the previous design, the screening and grit removal facility was adjacent to the aeration basins making it simple to branch off the process air system to supply air to the single drop diffusers. With the new land available, the screenings and grit facility will be relocated to the South allowing for a single-phase

construction sequencing of the new treatment facilities. A branch off the process air system is not practical based on the distance between the screening and grit removal facility and the aeration basins. A separate blower system will be designed in the screening and grit removal facility to supply air to the single drop diffusers. We anticipate using small positive displacement blowers to supply the air to the single drop diffusers. Location and horsepower of this system will be coordinated during detailed design.

Table 6.8. Single Drop Design Criteria

Design Parameter	Value
Number of Units	18
Design Airflow per Diffusers (scfm)	10
Approximate Diffuser Spacing (ft)	3
Water Depth in Channel (ft)	21

The basis of design for influent sampling is listed below in Table 6.9. The location and number of influent samplers will be finalized during detailed design.

Table 6.9. Influent Sampler Design Criteria

Design Parameter	Value
Number of Units	2
Type	Peristaltic
Sampling Liquid	Plant Influent
Enclosure	Integral Weatherproof
Area Classification	Unclassified

Primary Clarifiers and Primary Sludge Pumping

Two 115-ft diameter primary clarifiers will be installed for the 16 mgd design. Influent and effluent piping will be sized for the 24 mgd peak flow such that a third primary clarifier would be required at the future expansion to 24 mgd. The primary clarifiers will be provided with fiber-reinforced plastic (FRP) launder covers with intake pipes and a foul air suction pipeline for odor control. Table 6.10 presents the primary clarifier design criteria.

Table 6.10. Primary Clarifier Design Criteria

Design Parameter	Value
Primary Clarifiers	
Number of Units	2
Type of Sludge Collection Mechanism	Scraper Type
Type of Scum Collection Mechanism	Extended Scum Beach
Materials of Construction	304 stainless steel – submerged 316 stainless steel – at water line Aluminum – handrails and grating
Manufacturers	Envirex/Evoqua, Ovivo, Walker Process Equipment
Inside Tank Diameter (feet)	115
Side Water Depth (feet)	14
Tank Bottom Slope (inches/foot)	1
Average Daily Flow (mgd)	16
Surface Overflow Rate at ADF (gpd/sf)	770
Peak Hydraulic Flow (mgd)	40
SOR at PHF (gpd/sf)	1,926
Primary Scum Pumps	
Number of Pumps	2
Type of Pumps	Single disc or double disc
Pump Capacity (gpm)	125
Manufacturers	Wastecorp or Penn Valley
Horsepower	7.5

Primary sludge pumps will be single- or double-disc positive displacement pumps located in a slab-on-grade pump station. Inline grinders will be provided on the suction line from each clarifier. The two duty pumps and one standby pump will be tied to a common suction header with isolation valves configured such that one pump will be dedicated to each clarifier during normal operation to provide positive control of sludge removal from each clarifier. Primary sludge pumps will be provided with variable frequency drives (VFDs) to allow for pump speed modulation. Space shall be provided in the primary sludge pump station to add a fourth primary sludge pump when a third primary clarifier is required.

The primary scum pumps will utilize single- or double-disc pumps which shall be directly connected to the scum beach at each primary clarifier. Primary clarifier scum pumps will be provided with an FRP enclosure with heater designed to be easily removed to facilitate maintenance. Table 6.11 presents the primary sludge pump design criteria.

Table 6.11. Primary Sludge Pump Station Design Criteria

Design Parameter	Value
Primary Sludge Grinders	
Number of Grinders	3
Type	Inline
Manufacturers	JWC
Primary Sludge Pumps	
Number of Pumps	3
Type of Pumps	Single Disc or double disc
Manufacturers	Wastecorp or Penn Valley
Pump Capacity (gpm)	100
Speed Control	VFD
Solids Concentration (%)	0 – 6
Motor Horsepower	7.5

Aeration Basins and Blower Building

Four aeration basins will be provided under the 16-mgd design to meet the NPDES permit limits. The basis of design of the aeration basins is the 3-stage BNR process. The basins will be designed with the flexibility to convert to 5-stage BNR in the future if required by more stringent effluent nutrient limits. All aeration basins will be equipped with membrane-type fine bubble diffusers. Mixing will be provided in the cells that can be operated in an anaerobic or anoxic mode. Nitrified recycle (NRCY) pumps will be installed in each aeration tank at 16 mgd to return nitrified mixed liquor to the anoxic zone for denitrification to recover alkalinity. Table 6.12 summarizes the design criteria for the aeration basins.

Table 6.12. Aeration Basin Design Criteria

Design Parameter	Value
Aeration Basins	
Number of Basins	4
Volume per Basin (MG)	1.86
Number of Cells per Basin	11
Fine Bubble Diffuser Type in Cells	9" Membrane
Coarse Bubble Diffuser Type in Effluent Channel	Single Drop
Influent Channel Mixing	
Number of Units	3
Type	High-speed Submersible
Manufacturers	Xylem/Flygt, Sulzer/ABS, KSB, Landia
Aeration Basin Mixing	
Mixing in Cells A, C, & D	Big Bubble
Number of Units per Cell	6
Type	Minion Big Bubble
Manufacturers	World Water Works
Mixing in Cell B	Mechanical
Number of Mixers per Cell	1
Type	High-speed Submersible
Manufacturers	Xylem/Flygt, Sulzer/ABS, KSB, Landia
Nitrified Recycle Pumps	
Number of Pumps	4
Pump Capacity (gpm)	11,100
Type of Pump	Submersible Propeller
Manufacturers	Xylem/Flygt, Sulzer/ABS, KSB. Wilo. Landia?
Speed Control	VFD
Surface Waste Activated Sludge Pumps	
Number of Pumps	2
Type of Pump	Submersible
Manufacturers	Xylem/Flygt, Pentair
Speed Control	VFD

It is anticipated that the blower building will be equipped with four high-speed direct drive turbo blowers. Turbo blowers provide an opportunity for longer term power savings due to increased efficiency compared to multi-stage centrifugal blowers. The blower building will also house the main electrical service for the new facility. The blower building will be designed for a buildout of five total blowers. Table 6.13 provides the design criteria of the blowers.

Table 6.13. Aeration Blower Design Criteria

Design Parameter	Value
Number of Blowers	2 small, 2 large
Blower Capacity, Small (SCFM)	3,400
Blower Capacity, Large (SCFM)	5,100
Blower Type	High-speed Direct-Drive Turbo
Manufacturer	Sulzer/ABS, APG Neuros
Blower Horsepower, Small	250
Blower Horsepower, Large	350
Speed Control	VFD

With the current NPDES permit, nutrient limits are not implemented at 24 MGD. The original 2009 PER, however, included speculative nutrient limits that the previous design was based on. The speculative effluent nutrient limits were a TN of 6.0 mg/L and TP of 2.0 mg/L. Space is allocated on the site for addition of five future tanks as required to provide 5-Stage BNR level treatment at 24 MGD to meet these nutrient limits. Table 6.14 presents the required number of basins for 20 MGD and 24 MGD based on the type of limits and basin configuration.

Table 6.14. Basin Requirements for 20 MGD and 24 MGD

Type of Limits	Basin Configuration	20 MGD Capacity	24 MGD Capacity
No TN & TP Limits - Current	3-stage	5 basins	6 basins
Future TN & TP Limits	5-stage	8 basins	9 basins

Secondary Clarifiers and Return Activated Sludge Pumping

Three 160-foot diameter secondary clarifiers are recommended for the new SSWWTP plant. The three units are adequate for the 16- and 20-mgd design flows; however, a fourth unit will be required for the 24-mgd expansion. The secondary clarifiers will be provided with FRP launder covers with intake pipes to control the growth of algae. Table 6.15 presents the secondary clarifier design criteria.

Table 6.15. Secondary Clarifier Design Criteria

Design Parameter	Value
Secondary Clarifiers	
Number of Units	3
Type of Sludge Collection Mechanism	Hydraulic Removal
Type of Scum Collection Mechanism	Rotating Scum Trough
Materials of Construction	304 stainless steel – submerged 316 stainless steel – at water line Aluminum – handrails and grating
Manufacturers	Envirex/Evoqua, Ovivo, Walker Process Equipment
Inside Tank Diameter (feet)	160
Side Water Depth (feet)	18
Average Daily Flow (mgd)	5.33
Surface Overflow Rate at ADF (gpd/sf)	265
Peak Hydraulic Flow (mgd)	40
SOR at PHF (gpd/sf)	663
Secondary Scum Pumps	
Number of Pumps	4
Type of Pumps	Single disc or double disc
Pump Capacity (gpm)	125
Manufacturers	Penn Valley, Wastecorp
Horsepower	7.5

Secondary clarifier scum pumps will be provided with an FRP enclosure with a heater designed to be easily removed to facilitate maintenance.

Return activated sludge (RAS) will be pumped using horizontal screw centrifugal pumps. The pumps will be in a dedicated slab-on-grade pump station. Suction will always be flooded. Duty and standby pumps will be tied to a common suction header with isolation valves configured such that one pump will be dedicated to each clarifier during normal operation to provide positive control of RAS removal from each clarifier. To allow for flow control, the RAS pumps will be provided with VFDs, and each clarifier's RAS suction line will pass through a magnetic flow meter. Space for a fifth RAS pump will be provided in the new RAS pump station for the 24-mgd plant expansion when the fourth secondary clarifier is needed. Table 6.16 provides the design criteria for the RAS pumps.

Table 6.16. Return Activated Sludge Pump Station Design Criteria

Design Parameter	Value
Return Activated Sludge Pumps	
Number of Pumps	4
Type of Pumps	Horizontal Screw Centrifugal
Manufacturers	Pentair/Fairbanks Morse, Hayward Gordon and Wemco
Pump Capacity (gpm)	5,787 gpm
Speed Control	VFD
Motor Horsepower	50

Tertiary Filters

Tertiary filters will be outside-in style cloth media disk filters. Seven cloth-media disk filter units will be installed for the 16-mgd design, providing a filter loading rate of 2.1 gpm/ft^2 at maximum month flow and a filter loading rate of 6.2 gpm/ft^2 at peak hour flow with one filter unit out of service. The disk filters will be installed inside stainless steel tanks provided by the filter manufacturer. Each filter unit will have a dedicated backwash pump assembly provided by the filter manufacturer. Filtered effluent from within each filter unit will be used for backwashing, and therefore no external backwash supply is needed. Table 6.17 summarizes the tertiary filter design criteria.

The layout of the filters will allow for ease of future expansion, and space is allocated on the site for three additional disk filter units required for an expansion to 24 mgd. There are two options for the total number of disk filters needed when the plant expands from 16 mgd to 20 mgd based on the level of redundancy that is desired. Option 1 for the expanded flow to 20 mgd is to add one additional filter (for a total of 8 filters), which would allow the hydraulic loading rate to stay below the targeted 6.5 gpm/ft^2 if all filters are in service at the peak flow of 50 mgd and if one filter is out of service at 75% of peak flow (37.5 mgd). The hydraulic loading rate would exceed the targeted 6.5 gpm/ft^2 under the scenario of peak flow (50 mgd) with one filter unit out of service. Option 2 for the expanded flow to 20 mgd is to add two additional filters (for a total of 9 filters), which would allow the hydraulic loading rate to stay below the targeted 6.5 gpm/ft^2 at peak flow (50 mgd) with one filter unit out of service.

Table 6.17. Tertiary Filter Design Criteria

Design Parameter	Value
Number of Units	7
Filter Type	Outside-in Style Disk Filter
Media Type	Cloth
Number of Disks per Unit	14
Filter Area per Disk (ft^2)	53.8
Total Number of Disks	98
Total Filter Area (ft^2)	5,272
Hydraulic Loading Rate @ MMF (gpm/ft^2)	2.11
Hydraulic Loading Rate @ PHF (gpm/ft^2)	5.27
Hydraulic Loading Rate @ PHF with 1 unit OOS (gpm/ft^2)	6.15
Solids Loading Rate @ PHF and Peak TSS Loading ($lbs/d/ft^2$)	1.9

Ultraviolet Disinfection Facility

Design criteria for the new UV facility are summarized in Table 6.18. The UV disinfection facility will use low pressure, high intensity lamps and will provide a UV dose of 40 mJ/cm^2 at the peak hour flow to meet the NPDES limits for *Enterococcus*.

Table 6.18. UV Disinfection Facility Design Criteria

Design Parameter	Value
Peak Flow (mgd)	40
Minimum UVT (%)	50
Mínimum UV Dose (mJ/ cm^2 MS2 RED)	40
Redundancy	Redundant channel at peak flow
Disinfection Criteria (Enterococcus/100 mL)	35 / 100mL monthly geometric mean 276 / 100mL weekly geometric mean

The design minimum UVT value 50% is based on the design UVT value for the existing UV system and on weekly secondary effluent UVT data from October 2019 to October 2023 as presented in Figure 23**.** The tenth percentile of the secondary effluent UVT data from this period is 48%; however, the plant effluent UVT is expected to increase when tertiary filters are installed in the new plant. In February 2024, UVT was tested in secondary effluent and after filtering the same sample in the laboratory; these tests demonstrated that filtration will likely increase UVT by 2 percentage points.

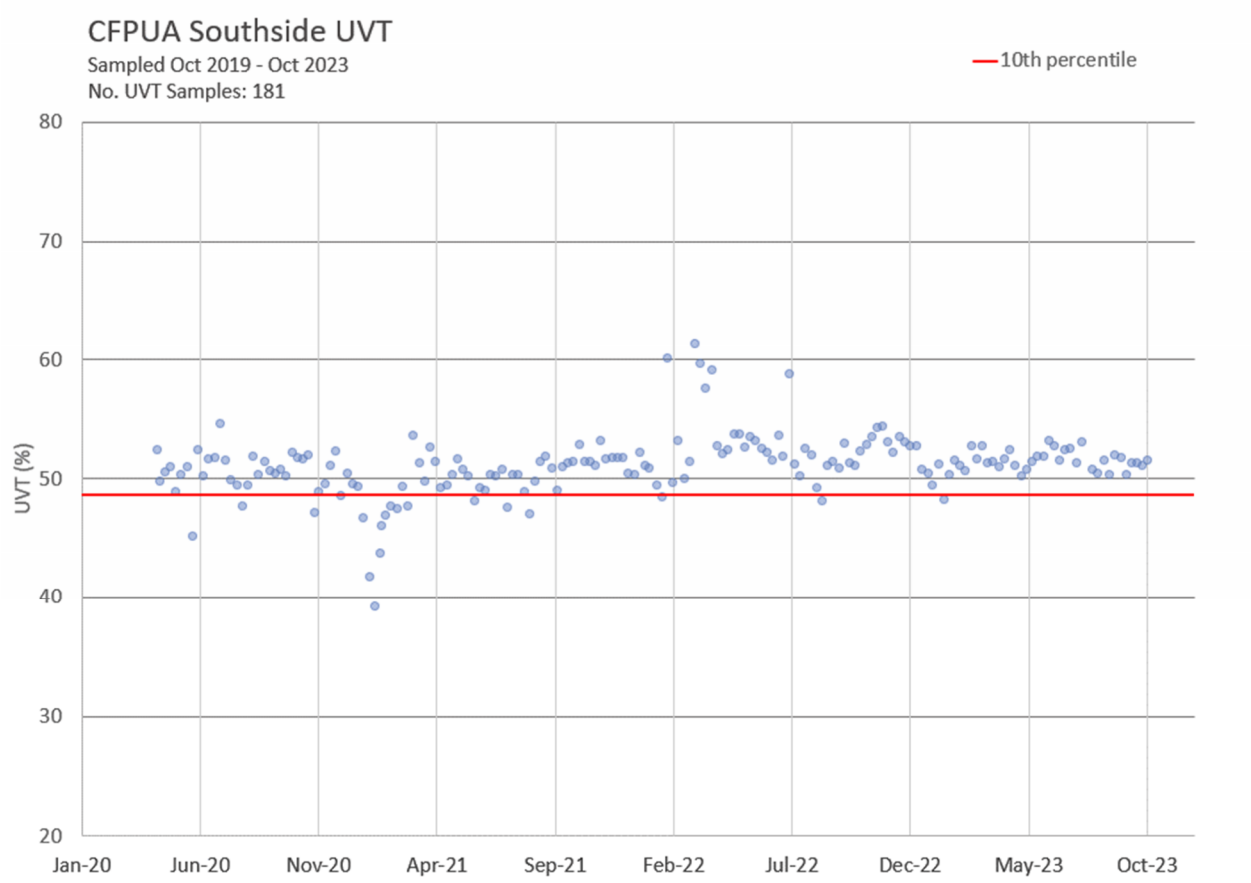


Figure 23. Weekly Secondary Effluent UVT (Oct 2019 – Oct 2023)

On April 5, 2024, Trojan performed collimated beam (CB) testing and particle size analysis on an unfiltered secondary effluent (before disinfection) sample, as well as CB testing on a secondary effluent sample that Trojan filtered using a 15-micron filter. Figure 24 and Figure 25 illustrate the results of the CB test and particle size analysis, respectively.

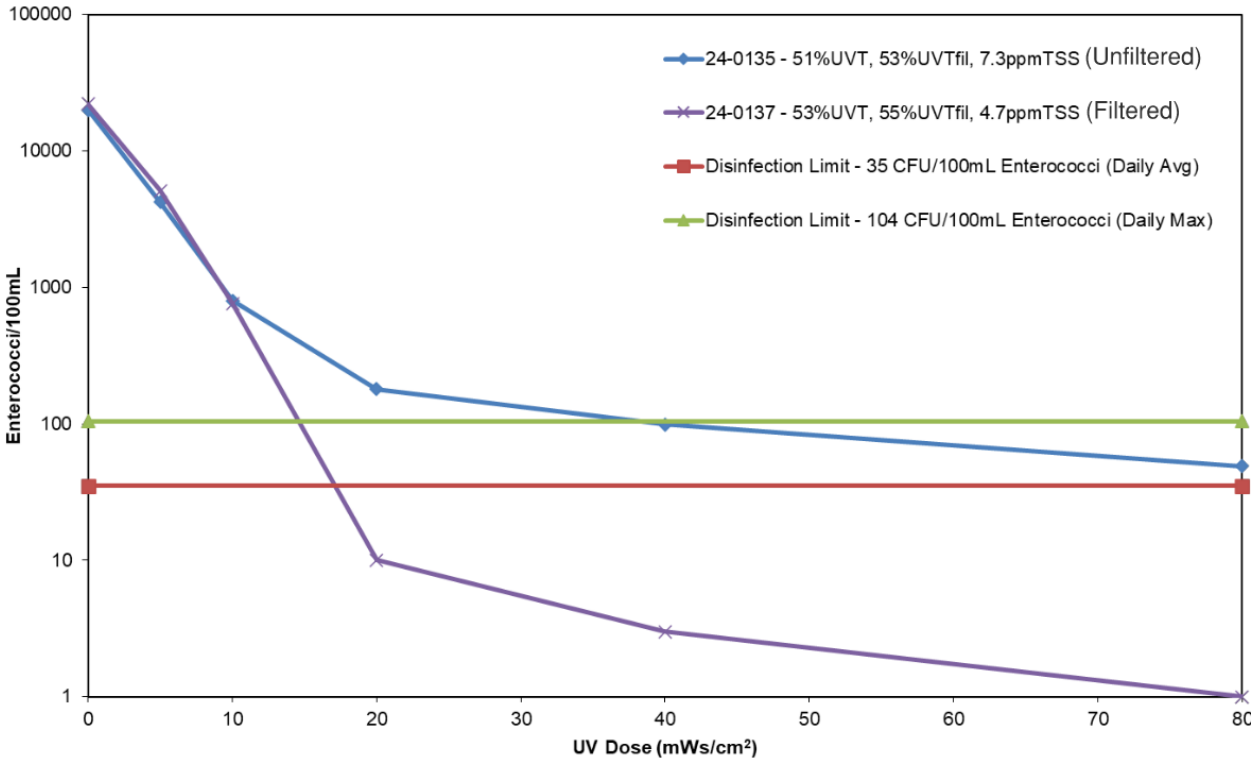


Figure 24. Collimated Beam Test Results (April 5, 2024)

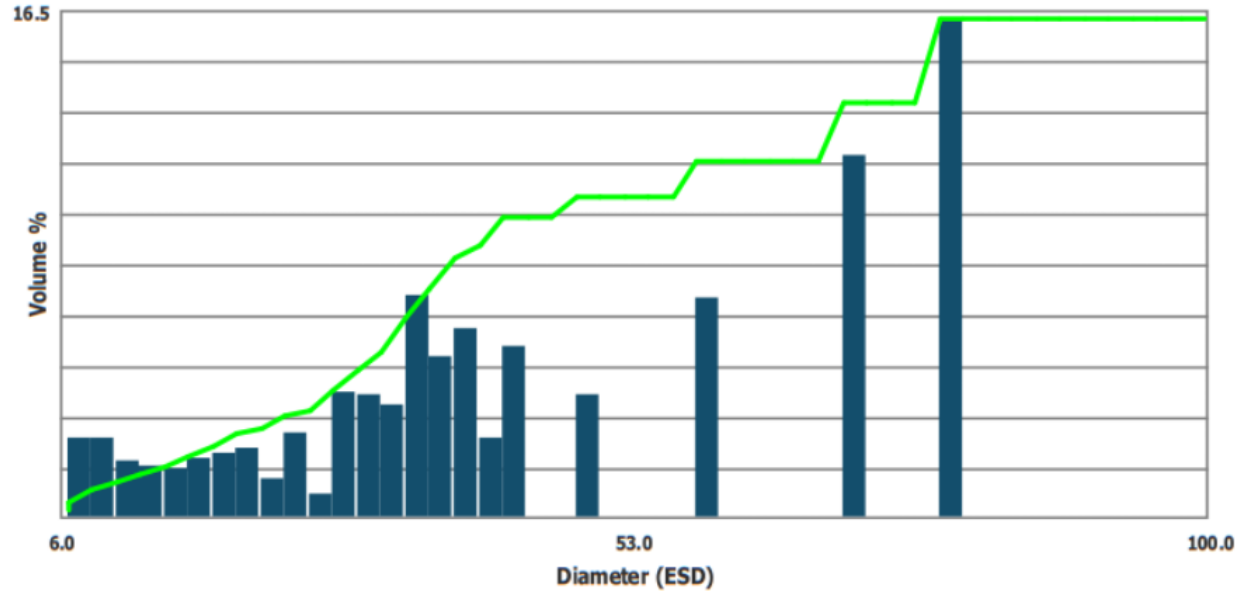


Figure 25. Particle Size Analysis Results

The unfiltered secondary effluent sample had a UVT of 51% and filtering the sample increased the UVT to 53%, improving UVT by 2% similar to UVT tests on site. Figure 25 illustrates that this unfiltered sample did not reach the permit limit for *Enterococcus* even with a UV dose of 80 mJ/cm^2. However, filtering the sample significantly reduced the UV dose required to meet the *Enterococcus* permit limits. In this filtered sample, the *Enterococcus* permit limit was achieved

with a dose of 18 mJ/cm^2 as *Enterococcus* RED, equivalent to 28 mJ/cm^2 as MS2 RED. The design dose will include a safety factor to account for variability in water quality and to achieve an effluent *Enterococcus* concentration that is below 35 cfu/100 mL instead of just at 35 cfu/100 mL. Accordingly, a design dose of 40 mJ/cm^2 as MS2 RED is recommended.

The particle size analysis in Figure 25 illustrates that this sample of secondary effluent had many particles larger than 30 microns, which shield bacteria from UV light and increase the UV dose needed for disinfection. Filtering the sample with a 15-micron filter greatly improved the effectiveness of UV disinfection. This suggests that the new filters, which will be designed for a maximum 10-micron pore size, will aid in the disinfection performance of the UV Facility.

The UV facility will include one standby channel at the peak hour flow in the initial construction project, and in future expansions, standby equipment can be provided as one standby channel or standby bank per channel. Fixed serpentine weirs in each channel will be used to maintain a near-constant water level at the UV lamps. Flow will then pass through a Parshall flume before being discharged to the Cape Fear River.

The new UV facility can potentially reuse the existing Trojan UVSigna 2-Row UV equipment, in which case the new UV equipment would be Trojan UVSigna 2-Row with 24-lamp banks to match the bank size of existing equipment, and the channel width of the new UV system would match the existing UV channel width. Design data for the option of reusing existing UV equipment is listed in Table 6.19.

Alternatively, the new UV facility can have all new UV equipment by either Trojan or Wedeco. This approach allows the UV system to have different sized banks and channel widths compared to the existing UV system, which could potentially reduce the total number of lamps needed and therefore the total connected load (i.e., Trojan proposes 20-lamp banks for the all-new equipment option, instead of the existing 24-lamp banks; this would result in less total connected power than existing). However, this option would require purchasing more new equipment than the option of reusing existing equipment. A UV facility with all new equipment would simplify construction and startup. Design data for the option of all new UV equipment is listed in Table 6.20.

Table 6.19. UV Disinfection Facility Design – Reusing Equipment

Design Parameter	Value
Manufacturer	Trojan UV
Model	UVSigna 2-Row
Number of Channels	3 total (2 duty + 1 standby)*
Number of Banks per Channel	5 duty
Total Existing Banks to be Reused	8
New Banks Required	7
Lamps per Bank	24
Total Number of Lamps	360
Channel Length, ft	35.9
Channel Width, ft	5.4
Channel Depth, ft	7.8
Weir Length, ft	43.4
Head Loss Across UV Banks, inches	3.9
Total PDCs to be Reused	2 Double PDCs
New PDCs to be Purchased	4
Ballast Input Power per Lamp, Watts	1,000
Total connected power, including redundant equipment, kW	409.1
*An additional channel will be required for the expansion to 50 mgd peak	

Table 6.20. UV Disinfection Facility Design – All New Equipment

Design Parameter	Trojan UV	Wedeco
Model	UVSigna 2-Row	Duron 8
Number of Channels	3 total (2 duty + 1 standby)	4 total (3 duty + 1 standby)
Number of Banks per Channel	5 duty	4 duty
Lamps per Bank	20	32
Total Number of Lamps	300	512
Channel Length, ft	35.9	47.7
Channel Width, ft	4.7	6.5
Channel Depth, ft	7.8	8.8
Head Loss Across UV Banks, inches	5.3	3.2
Total PDCs / Ballasts Cabinets	6	7
Ballast Input Power per Lamp, Watts	1,000	800
Total connected power, including redundant equipment, kW	339.8	503
* An additional channel will be required for the expansion to 50 mgd peak ** For expansion to 50 and 60 mgd, there would be 4 duty channels and redundancy would come from additional banks per channel.		

Outfall

The outfall will convey flow from the UV disinfection facility, where it will pass through a Parshall flume, to the Cape Fear River. The pipe will be approximately 60 inches in diameter and manufactured of either prestressed concrete cylinder pipe (PCCP), reinforced concrete pipe (RCP), high density polyethylene pipe (HDPE), ductile iron pipe (DIP), or fiberglass reinforced plastic pipe (FRP). At the discharge, an outfall structure will protect the riverbank from erosion that may occur due to flow from the pipe. The design of the new headwall will be like the existing outfall and will comply with any requirements defined by regulatory agencies. The location along the riverbank of the outfall will seek to reduce the need for extensive construction in the river. The discharge design will also place the effluent flow stream into the current stream of the river to help with effluent mixing.

Reclaimed Water Pump Station

A reclaimed water pump station will be provided to supply plant reuse water for all facilities requiring service water. The pump station will be connected at the end of the UV facility with a wetwell containing vertical turbine pumps to convey flow throughout the treatment plant. An additional slot will be included in the wetwell of the RCW pump station to allow for an additional pump to be installed in the future for plant expansion. The reclaimed water pumps will be sized to provide all service and peak flow demands for the treatment plant. Variable frequency drives (VFDs) will be provided to allow for adjustment of RCW flow to meet system and pressure demands. The design criteria for the reclaimed water pumps is shown in Table 6.21 below.

Table 6.21. Reclaimed Water Pump Station Design Criteria

Design Parameter	Value
Reclaimed Water Pumps	
Number of Pumps	3
Pump Capacity (gpm)	1,000
Type of Pumps	Vertical Turbine
Manufacturers	Fairbanks, Sulzer, Flowserve, or Johnston
Speed Control	VFD
Motor Horsepower	100

Drain Pump Station

A drain pump station will be provided to drain all facilities and pump it to the influent channel at the headworks. The pump station will be a wet-pit submersible non-clog style with a valve vault near grade for isolation and access. The top of the drain pump station shall be level with the aeration basins to eliminate the risk of overflowing the pump station. The drain pumps will be sized to drain the largest facility in 24 hours. The design criteria for the drain pumps is summarized in Table 6.22.

Table 6.22. Drain Pump Station Design Criteria

Design Parameter	Value
Drain Pump Station Pumps	
Number of Pumps	2
Pump Capacity (gpm)	2,000
Type of Pumps	Submersible Non-Clog
Manufacturers	Fairbanks, Flygt, Sulzer, Wilo
Speed Control	Constant Speed
Motor Horsepower	60

Thickening and Dewatering Equipment and Building

Waste activated sludge (WAS) will be thickened upstream of anaerobic digestion. Thickening will be provided by gravity belt thickener (GBT) equipment to be installed in the new solids building. The recommended facilities will include three 2.0-meter operating width GBTs to serve the 16, 20 and 24 mgd permitted plant capacities. Design criteria for the thickening system is shown in Table 6.23. WAS will be pulled off the RAS line at the aeration basins and pumped to the GBTs via GBT feed pumps located in the new solids building. Thickened sludge will be pumped from the GBTs to either a thickened sludge storage tank, or alternatively directly to the anaerobic digesters.

Table 6.23. Thickening Equipment Design Criteria

Design Parameter	Value
Gravity Belt Thickeners	
Number of Units	3
Belt Width (m)	2
Manufacturers	Andritz, Ashbrook, BDP
Design Hydraulic Loading Rate (gpm)	600
Design Solids Loading Rate (lbs/hr)	1800
GBT Feed Pumps	
Number of Pumps	3
Type of Pumps	Rotary Lobe
Manufacturers	Boerger, Lobepro, Vogelsang
Pump Capacity (gpm)	550
Maximum pump speed (rpm)	300
WAS Feed Solids Range (% TS)	0.5 – 1.0
Speed Control	VFD (25-100%)
Horsepower	50
Thickened WAS Pumps	
Number of Pumps	3
Type of Pumps	Progressive Cavity (2 stage)
Manufacturers	Moyno, Seepex, Netzsch
Pump Capacity (gpm)	100
Maximum pump speed (rpm)	300
Speed Control	VFD (25-100%)
Horsepower	25
Solids Concentration (%)	0 - 6

Emulsion polymer will be used for conditioning ahead of the GBTs. Polymer make-up units will be configured to directly feed an individual GBT, with piping and valving manifold to provide redundancy. The thickening polymer system design criteria is shown in Table 6.24. Liquid polymer facilities, including a bulk storage tank, recirculation pump, individual polymer mixing units, and polymer feed pumps will be provided for the belt filter presses. Final polymer concentrations will be determined through sampling performed by the GBT manufacturers.

Table 6.24. Thickening Polymer Design Criteria

Design Parameter	Value
Thickening Polymer Make-up Units	
Number of Units	3
Neat polymer capacity, gal/hr	6
Neat polymer pump turndown	10:1
Maximum dilution ratio	200:1
Minimum supply water pressure, psi	n/a (will require booster pump)
Polymer Bulk Storage Tank	
Quantity	1
Tank Capacity (gal)	9,000
Tank Material	FRP
Polymer Recirculation Pump	
Number of Pumps	1
Type of Pump	Progressive Cavity
Pump Capacity (gpm)	100
Speed Control	Constant
Horsepower	10

Anaerobically digested residuals dewatering will be provided by belt filter press (BFP) dewatering equipment to be installed in the new solids building. The recommended facilities will initially include three new 3-belt, 2.0-meter belt filter presses with space provided for a fourth to meet capacity demands for 20 or 24 mgd permitted capacities. Digested sludge will be pumped from the digesters to liquid sludge storage, then onto the BFPs via individual BFP feed pumps. The dewatering system design criteria are presented in Table 6.25.

Table 6.25. Dewatering Equipment Design Criteria

Design Parameter	Value
Belt Filter Press	
Number of Units	3+ 1 future
Belt Width (meter)	2
Number of Belts	3
Manufacturers	Alfa Laval, BDP, Charter
Design Hydraulic Loading Rate (gpm)	200
Design Solids Loading Rate (lbs/hr)	4,000
Solids Concentration (%)	1.5 - 4.0
BFP Feed Pumps	
Number of Pumps	4
Type of Pumps	Progressive Cavity (2 stage)
Manufacturers	Moyno, Seepex, Netzsch
Speed Control	VFD (25-100%)
Pump Capacity (gpm)	200
Maximum pump speed (rpm)	300
Horsepower	25
Solids Concentration (%)	0 – 4

Emulsion polymer will be used for conditioning ahead of the BFPs. Polymer make-up units will be configured to directly feed an individual BFP, with piping and valving manifold to provide redundancy. Dewatering polymer system design criteria are presented in Table 6.26.

Table 6.26. Dewatering Polymer Design Criteria

Design Parameter	Value
Dewatering Polymer Make-Up Units	
Number of Units	4
Neat Polymer Capacity, gal/hr	15
Neat Polymer Pump Turndown	10:1
Maximum Dilution Ratio	200:1
Minimum supply water pressure (psi)	N/A, will require booster pump
Polymer Bulk Storage Tank	
Quantity	1
Tank Capacity (gal)	9,000
Tank Material	FRP
Polymer Recirculation Pump	
Number of Pumps	1
Type of Pump	Progressive Cavity
Pump Capacity (gpm)	100
Speed Control	Constant
Horsepower	10

Dewatered cake will be transferred via sets of screw conveyors to a truck loading system located outside the solids building, or to the existing covered cake storage pad. Horizontal shaftless screw conveyors will move cake from the BFP discharge to inclined shafted screw conveyors, which in turn will pass cake outside of the building onto long horizontal conveyors that will transport the solids to a truck loading distribution conveyor or onto the existing covered solids storage pad. Motor-operated slide gates will control conveyor and truck loading. Table 6.27 summarizes the conveyor design criteria.

Table 6.27. Conveyor Design Criteria

Design Parameter	Value
BFP Discharge Conveyors	
Number of Conveyors	2
Conveyor Length (ft)	34.5
Conveyor Type	Shaftless
Minimum Design Load (lbs/hr)	25,000
Minimum Volumetric Rate (cu ft/ hr)	560
Maximum Bed Loading (%)	30
Screw Diameter (in)	16
Motor Horsepower	15
Inclined Conveyors	
Number of Conveyors	2
Conveyor Length (ft)	50
Conveyor Type	Shafted
Minimum Design Load (lbs/hr)	25,000
Minimum Volumetric Rate (cu ft/hr)	560
Maximum Bed Loading (%)	30
Screw Diameter (in)	18
Incline (degrees)	25
Motor Horsepower	20
Long Horizontal Conveyors	
Number of Conveyors	2
Conveyor Length (ft)	120
Conveyor Type	Shafted
Minimum Design Load (lbs/hr)	25,000
Minimum Volumetric Rate (cu ft/hr)	560
Maximum Bed Loading (%)	30
Screw Diameter (in)	20
Motor Horsepower	40
Truck Loading Conveyors	
Number of Conveyors	2
Conveyor Length (ft)	27
Conveyor Type	Shaftless
Minimum Volumetric Rate (cu ft/hr)	1,100
Maximum Bed Loading (%)	30
Screw Diameter (in)	20
Minimum Design Load (lbs/hr)	50,000
Motor Horsepower	20
Manufacturers	JMS, KWS, Schwing

Filtrate Pump Station

Filtrate from the thickening and dewatering equipment in the biosolids building is returned to the headworks for treatment. A filtrate pump station will be provided to accept thickening and dewatering filtrate drain and pump it to the headworks. This pump station will also accept flows from the vacuum unloading pads, septage receiving station, and digester emergency overflow. The pump station will be a wet-pit submersible non-clog style with a valve vault near grade for isolation and access. The filtrate pumps will be sized to accommodate peak flows. Variable frequency drives will be provided to allow for adjustment of in-coming flows to reduce excessive pump cycling. The design criteria for the filtrate pumps can be found in Table 6.28.

Table 6.28. Filtrate Pump Station Design Criteria

Design Parameter	Value
Filtrate Pump Station Pumps	
Number of Pumps	4
Pump Capacity (gpm)	1,500
Type of Pumps	Submersible Non-Clog
Manufacturers	Fairbanks, Flygt, Sulzer
Speed Control	VFD
Motor Horsepower	100

Liquid Sludge Storage Tanks

Liquid sludge storage tanks will be provided to accommodate fluctuations in solids processing requirements at the treatment facility. TWAS storage will allow for intermittent thickening and continuous digester feed. Likewise, digested sludge storage will decouple digester withdrawal and dewatering. A third, flex tank will be provided to offer redundancy for TWAS and digested sludge storage. The tanks will be constructed of cast-in-place concrete with common wall construction. Liquid sludge storage tank design criteria are presented in Table 6.29.

Table 6.29. Liquid Sludge Storage Design Criteria

Design Parameter	Value
Number of Tanks	3
Volume per Tank (gal)	50,000
Interior Length (ft)	20
Interior Width (ft)	20
Sidewall Depth (ft)	16.7
Number of Mixers per Tank	1
Typer of Mixer	Vertical Turbine, Platform Mounted
Manufacturers	Philadelphia, Chemineer
Horsepower	15

Anaerobic Digesters and Digester Control Building

Anaerobic digestion will be provided at the SSWWTP to digest TWAS and primary sludge (PS) prior to dewatering. The digesters will be designed to meet Class B pathogen reduction (PR) and vector attraction reduction (VAR) requirements under the Process to Significantly Reduce Pathogens (PSRP) requirements of 40 CFR 503 and the applicable North Carolina Administrative Code (NCAC) 2T.1100 requirements. Three digesters will be provided for the 16-mgd plant capacity; the addition of a fourth digester would be required for the 20- and 24-mgd plant capacity.

The digester complex will include gas treatment, hot water boilers, low pressure gas storage, and waste gas flares.

Digester sizing is dictated by the process stabilization goals and volume of the feed sludge in the digester. Class B stabilization of biosolids requires a sludge retention time (SRT) of 15 days at or above 95°F to meet the 40 CFR 503 regulatory requirements. Sizing of digestion facilities is based on meeting at least a 15-day solids retention time (SRT) under MAX30 loading conditions with one tank out of service or MAX14 day loading conditions with all tanks in service, whichever requires the larger tank volume. (Note: SRT = hydraulic retention time (HRT) in the absence of recuperative thickening). CFPUA selected to base the anaerobic digester design on a 2.3% TSS PS concentration (10^{th} percentile value) to ensure process performance across the broadest range of possible operating conditions; if the digester feed solids are more concentrated, then the required treatment volume could be reduced, or the digester residence time would be greater than the 15-day target level. However, it is critical to consider the likelihood and duration of thinner feed sludge conditions to avoid failure to meet a 15-day SRT and the production of unclassified sludge. Table 6.30 presents the anaerobic digester tankage design criteria.

Table 6.30. Design Criteria for Anaerobic Digester Tankage

Design Parameter	Value	
Number of Units	3 for 16 MGD, +1 future for 20 or 24MGD	
Inside Diameter	85 ft	
Sidewall Height	43 ft	
Normal Operating Elevation	37.75 ft	
Emergency Overflow Elevation	42 ft	
Normal Operating Volume	1,600,000 gallons per tank	
HRT at 16 MGD, days*[1]	Annual Average	Maximum Month
Digestion HRT - All Units in Service	31.1	23.7
Digestion HRT - One Out of Service	20.7	15.8
1: Calculated assuming 2.3% primary sludge.		

Figure 26 shows the allowances given for volume expansion due to gas hold-up, active digestion volume, and grit accumulation allowances. Note that the active digestion volume includes a 5% volume allowance for the possible addition of high strength waste such as fats, oils, and grease (FOG), shown in Figure 26.

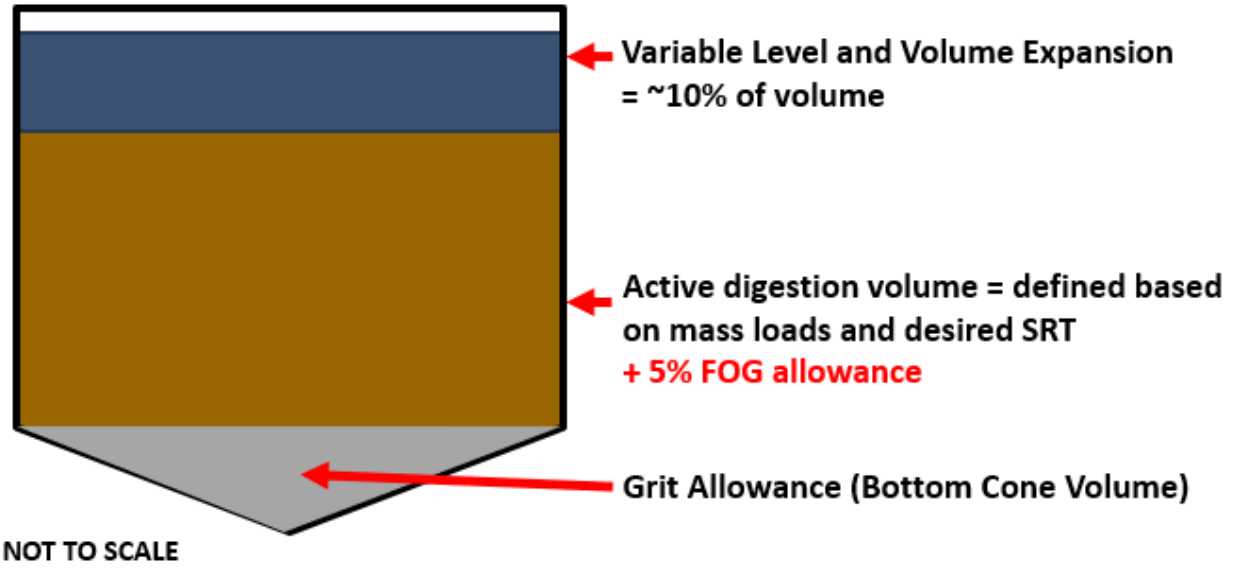


Figure 26. Digester Volume Allocations

PS and TWAS will combine just before the feed point to each digester tank. PS will be delivered by the primary sludge pumps which will be in the primary sludge pump station adjacent to the primary clarifiers. TWAS may come directly from the gravity belt thickeners (GBT) or may be stored in the TWAS liquid sludge storage tank. If TWAS is fed directly from the GBTs, the TWAS transfer pumps will be used to bypass liquid sludge storage and feed the digestion system. If TWAS is fed from the liquid sludge storage, it will be pumped by the digester feed pumps. In this case, TWAS from the gravity belt thickeners will be first pumped from the gravity belt thickeners into the liquid sludge storage (LSS) by the TWAS pumps. From the LSS, the TWAS will be fed to the digesters via the digester feed pumps located in the thickening and dewatering building. The design criteria for the digester feed pumps are shown in Table 6.31. TWAS can also be transferred by the TWAS pumps directly to the digesters, bypassing the LSS, via interconnecting piping in the thickening and dewatering building.

Table 6.31. Digester Feed Pump Design Criteria

Design Parameter	Value
Digester Feed Pumps	
Number of Pumps	2 (1 Duty + 1 Standby)
Type of Pump	Progressive Cavity
Manufacturers	Moyno, Seepex, Netzsch
Pump Capacity (gpm)	150
Speed Control	VFD
Horsepower	TBD
Solids Concentration (%)	4-7

The PS and TWAS will be pumped in separate force mains into the digester facilities and combined just before entering the digesters. Motor operated valves will be provided to facilitate automatic feed cycling to the digesters. Flow meters will be provided on the PS and TWAS lines to measure (totalize) the sludge feed streams to each digester.

Effective mixing of the digester contents is important for process stability, maximizing gas production, minimizing scum and foam formation, and preventing solids and grit deposition inside the digester tank.

The proposed pump mixing system includes a duty and standby mixing pump for each. The design criteria for the digester mixing pumps are shown in Table 6.32.

Table 6.32. Design Criteria for Digester Mixing Pumps

Design Parameter	Value
Digester Mixing Pumps	
Number of Pumps	3 duty + 3 standby
Type of Pump	Horizontal Centrifugal Chopper Pump
Manufacturers	Vaughan
Pump Capacity (gpm)	6,600
Speed Control	VFD
Horsepower	100
Solids Concentration (%)	0 - 6

The discharge nozzle arrangement of the mixing system varies amongst manufacturers, but the general arrangement of the system includes double nozzle assemblies on the tank floor, with single nozzle assemblies on the wall.

For the mesophilic anaerobic digestion process to function properly, sludge temperatures inside the digesters will need to be maintained between 95°F to 100°F. The digester heating system is sized to provide heating sufficient for maximum week loading under winter conditions. Mesophilic digester contents will be heated by recirculating sludge from each digester through a grinder and dedicated hot water / sludge heat exchanger. The sludge recirculation pumps will have a dedicated pump per digester with a shared standby pump.

Hot water for the primary hot water loop will be heated to 200°F by two duty and one standby fire-tube boilers. A dedicated secondary hot water loop pump will pump hot water through each heat exchanger. The circulated sludge will be heated to temperature as it passes through the heat exchangers. A three-way control valve will connect the primary and secondary hot water loops and ensure sufficient hot water from the primary loop enters the secondary loop to meet the digester heating demand.

One heat exchanger (HEX) will be provided for each digester. HEX design criteria are displayed in Table 6.33.

Table 6.33. Digestion HEX Design Criteria

Design Parameter	Value	
Digester Heat Exchangers (HEXs)		
Type	Tube-in-Tube HEX	
Number of Units	3	
Heating Capacity	2.0 MMBtu/hr	
Pressure Rating	60 psi	
Digester Temperature	97°F	
Winter Air Temperature	35°F	
Ground Temperature	55°F	
Winter Digester Feed Temperature	57°F	
Digester Feed Volume[1]	124,031 gallons/day	
	Sludge	Hot Water
Flowrate	350 gpm	150 gpm
Temperature Entering HEX	95°F	150°F
1: This feed rate is associated with maximum week loading, 2.3% PS, and two (2) digesters in service. This condition has an SRT of 12.9 days.		

Digester heating will require 2.0 MMBTU/hr for each HEX. Two (2) 3.0 MMBTU/hr (output) fire-tube boilers will supply this heat for each of the three (3) HEXs. Boiler design criteria is displayed in Table 6.34. If a future 4th digester is added to expand plant capacity to 20 or 24 mgd, an additional 2.0 MMBTU/hr heating capacity will be needed. To meet the future heat demand of four digesters, the 3.0 MMBTU/hr boilers will need to be replaced with 4.0 MMBTU/hr (output) units. The future boiler system will still use two (2) duty units and one (1) standby unit. The placement of the boilers in the digester equipment building will be done so that the larger boiler can be installed without rearranging other equipment layout while also preserving the geometry and orientation of the boilers to their stacks. Preserving this geometry allows re-use of the stacks for the 3.0 MMBTU/hr units and avoids the need for structural changes to the digester building during the boiler replacement.

Table 6.34. Boiler Design Criteria

Design Parameter	Value
Fire Tube Boilers	
Type	Fire-Tube
Quantity	Three (3), (2 duty, 1 standby)
Manufacturers	Cleaver Brooks, Superior, Hurst or approved equal
Firing Rate Range	25-100%
Fuel Source	Digester Gas, LPG
Minimum Rated Output Capacity	3.0 MMBtu/hr per Boiler

The primary hot water loop will be heated by the boiler and used to maintain the temperature of the secondary hot water loop. The design criteria for the primary hot water pumps are shown in Table 6.35.

Table 6.35. Primary Hot Water Recirculation Pump Design Criteria

Design Parameter	Value
Primary Hot Water Recirculation Pumps	
Number of Pumps	Three (3), (2 duty, 1 standby)
Type of Pump	Horizontal End Suction Centrifugal
Manufacturers	Bell and Gossett, Taco, Armstrong
Pump Capacity (gpm)	400
Speed Control	Constant Speed
Temperature of Liquid Pumped	200°F
Horsepower	7.5

The secondary hot water loop will be maintained at a temperature setpoint and used to provide heat to the HEXs. The design criteria for the secondary hot water pumps are shown in Table 6.36.

Table 6.36. Secondary Hot Water Recirculation Pump Design Criteria

Design Parameter	Value
Secondary Hot Water Recirculation Pumps	
Number of Pumps	4
Type of Pump	Horizontal End Suction Centrifugal
Manufacturers	Bell and Gossett, Taco, Armstrong
Pump Capacity (gpm)	150
Speed Control	Constant Speed
Temperature of Liquid Pumped	150°F
Horsepower	3

The digested sludge heating recirculation pumps will pump sludge to the heat exchangers so that the internal digester temperature can be maintained at a setpoint. The design criteria for the digested sludge heating recirculation pumps are shown in **Table 6.37**.

Table 6.37. Digested Sludge Heating Recirculation Pump Design Criteria

Design Parameter	Value
Sludge Heating Recirculation Pumps	
Number of Pumps	Six (6); Four (4) duty, Two (2) standby
Type of Pump	Horizontal Recessed Impeller
Manufacturers	Haywood -Gordon, Vaughan, Wemco
Pump Capacity (gpm)	350
Speed Control	Constant Speed
Solids Concentration	1-4%

Digested sludge will be removed from the digesters by five (5) digested sludge transfer pumps; each digester will have a duty pump, digesters 1 and 2 will share a standby pump, and digester 3 will have a dedicated standby pump. Digested sludge transfer pump design criteria is shown in Table 6.38.

Table 6.38: Digested Sludge Transfer Pump Design Criteria

Design Parameter	Value
Digested Sludge Transfer Pumps	
Number of Pumps	5, 3 duty and 2 standby
Type of Pump	Progressive Cavity
Manufacturers	Seepex, Moyno, Netzsch
Pump Capacity (gpm)	225
Speed Control	VFD
Solids Concentration	1-4%

Each digester will have a dedicated standpipe for surface withdrawal, which will minimize any surface foam accumulation in the digester. Alternate withdrawal from lower digester levels will be provided with valving to the standpipe. The digester standpipe headspace will be connected to the digester headspace. As flow is pumped into the digester from the digested sludge transfer pumps, an equal amount of flow will be displaced to the digester standpipe for removal from the digester by the digested sludge transfer pumps.

An emergency overflow system will be provided for the digester tank to protect from unexpected rapid volume expansion (RVE) events. RVE is believed to occur because of an increase in gas holdup within the digester liquid. RVE is associated with changes in digester feed or mixing. The first line of defense in the event of a rapid volume expansion (RVE) event is the excess freeboard provided in the digester tank itself. A freeboard of 4.25 feet is provided to accommodate a RVE prior to overflow. The overflow system will have a liquid filled trap to provide a gas seal for the overflow piping. Digester overflow will be routed to the filtrate pump station and returned to the head of the plant.

Digester Gas Handling and Utilization Facilities

Digester gas produced in the anaerobic digestion process will be collected and conditioned for use in the hot water boilers and/or combined heat and power (CHP) system, with excess gas flared in the waste gas burners.

The estimated anaerobic gas production rates for various influent flow conditions are displayed in Table 6.39. These production rates will be used to inform sizing for the CHP system.

Table 6.39. Estimated Anaerobic Digestion System Gas Production at Various Influent Flows

Condition	Total Digester Gas Production (cfm)			
2 Digesters in Service	**8**	**16**	**20**	**24**
Maximum Week	146	261	303	N/A[2]
Maximum 2-Week	137	247	289	N/A[2]
Maximum Month	120	223	264	N/A[2]
Average Annual	93	179	216	N/A[2]
3 Digesters in Service	**8**	**16**	**20**	**24**
Maximum Week	149	284	341	391
Maximum 2-Week	139	266	322	371
Maximum Month	122	236	288	334
Average Annual	94	185	228	268
4 Digesters in Service	**8**	**16**	**20**	**24**
Maximum Week	N/A[1]	N/A[1]	N/A[1]	418
Maximum 2-Week	N/A[1]	N/A[1]	N/A[1]	393
Maximum Month	N/A[1]	N/A[1]	N/A[1]	350
Average Annual	N/A[1]	N/A[1]	N/A[1]	276

1: Note that the 8, 16, and 20 mgd influent flow conditions will only have 3 anaerobic digesters, making operation with 4 digesters in service not possible under these conditions.

2: Note that at the 24 mgd influent flow condition, the solids loading rate will be too high to only have 2 digesters in service without violating the minimum SRT criteria of 15 days.

It is common for anaerobic digesters to experience fluctuations in the rate of digester gas production. This can be due to changes in solids loading to the digester or process conditions within the digester. Gas production may temporarily drop or a "surge" in gas production may be observed. Digester gas collection piping and equipment must be sized to function under surge conditions. The analysis used to account for surge gas production was conducted by choosing either twice the annual average gas production or gas production at a 10-day SRT. This analysis was performed for both total and individual digester gas production. Results and important values are shown in Table 6.40.

Table 6.40. Digester Gas Production at Surge Rates

Condition	Total Digester Gas Production at Surge Rates (cfm)	
Total Digester Gas "Surge" Production (CFM)	10 Day SRT	2x(Average Annual)
2 Digesters in Service	353	498
3 Digesters in Service	530	537
4 Digesters in Service	N/A[2]	550
Total Digester Gas "Surge" Production Rate	550	
Individual Digester Gas "Surge" Production	10 Day SRT	2x(Average Annual)
Solo Digester Gas Production[1]	177	250[1]
Individual Digester Gas "Surge" Production Rate	250	

1: Individual digester gas production for a 10-day SRT digester is a function of digester volume. The annual average used to calculate the solo "2x annual average" is based on the gas production of one (1) of two (2) digesters, when two (2) digesters are in service at the 24 mgd condition.

2: The sludge production rate at 24 mgd is not sufficient to feed four (4) digesters at a 10-day SRT. For this reason, the calculated gas production at that condition was not considered as a plausible digester gas production surge rate.

Gas safety equipment will be provided as a means of protection against the system becoming over pressurized or falling into a vacuum condition. Dual pressure/vacuum relief (PVRV) valves will be provided on top of each digester, with a flame bank to prevent fire propagation into the digester. Each pair of PVRVs is provided with a safety selector valve to allow for maintenance and cleaning of the flame bank. Additionally, emergency pressure relief hatches will be provided on each digester to protect the fixed cover from over pressurization. If the pressure in the digester continues to rise above the PVRV setpoint, emergency hatches on top of the digesters will open and will relieve the pressure inside the tank. The emergency hatches also provide vacuum relief in the event of a vacuum condition. Digester gas safety equipment is listed in Table 6.41.

Table 6.41. Digester Gas Safety Equipment List

Gas Safety Equipment	Quantity per Digester
Safety Selector Valves	1
Pressure/Vacuum Relief Valve with Flame Arrestor	2

A condensate and sediment trap will be provided at each digester. Additionally, automatic drip traps will be provided at low points in the digester gas piping. Digester gas piping will be sloped towards the drip traps to facilitate collection and management of condensate.

Excess digester gas not utilized in the boiler or CHP system will be flared. The waste gas burners are safety equipment and sized for the peak estimated digester gas production. Design criteria for waste gas burners is displayed in Table 6.42.

Table 6.42. Design Criteria for Waste Gas Burners

Waste Gas Burner	Value
Type	Candle Stick
Number of Flares	2 (1 duty, 1 standby)
Capacity per Flare, SCFM	550
Pilot Fuel	LPG

Low-pressure gas storage will be provided to dampen swings in digester gas pressures that may be experienced with boiler or CHP cycling and provide short-term storage for times when the production rate is less than the consumption at the boilers or CHP, which helps prevent the need to flare digester gas that could otherwise be put to beneficial use. Low-pressure digester gas storage design criteria is displayed in Table 6.43.

Table 6.43. Low Pressure Digester Gas Storage Design Criteria

Design Parameter	Value
Storage Volume, cubic Feet	30,000
Mounting	Concrete, ground-mounted
Configuration	1/2 sphere
Size	50 feet, inner diameter

The digester gas will flow to the gas conditioning system as gas demand is detected from either the fire-tube boilers or the CHP system. Once the gas flows to the gas conditioning system, it will first be scrubbed for hydrogen sulfide (H2S) using vessels with iron-based media. Saturated digester gas will flow through two vessels filled with adsorptive media to remove hydrogen sulfide. Vessels will be sized such that media last 6-12 months before needing replacement. After H2S removal, digester gas will be compressed, chilled, and reheated by the gas compressor and moisture removal system to dry the gas to a 40°F dew point. Gas that fuels the combined heat and power system will flow through two vessels filled with activated carbon-based media to remove siloxanes from the dry digester gas. Design criteria for the digester gas conditioning equipment is displayed in **Table 6.44**.

Table 6.44. Digester Gas Conditioning Equipment Design Criteria

Design Parameter	Value
H2S Removal (Iron Sponge)	
Quantity	2 Vessels
Max Gas Throughput	260 SCFM
Average Gas Throughput	148 SCFM
H2S Inlet Concentration	800 ppmv
H2S Outlet Concentration	<5 ppmv
Media	Pelletized Ferric Hydroxide or comparable granular media
Gas Compressor and Moisture Removal	
Quantity	2
Compressor Type	Rotary Lobe
Compressor Drive	Variable Speed
Moisture Removal	Dual-core heat exchange with chilled water and gas reheat
Chiller System	Packaged system with dual pumps and dual refrigerant compressors
Outlet Pressure	5 psi
Dew Point	40°F
Particulate Removal	99.9%
Siloxane Removal	
Quantity	2
Max Gas Throughput	90-100 SCFM
Average Gas Throughput	90-100 SCFM
Siloxanes Inlet Concentration	1-3 PPMV (assumed)
Volatile Organic Compounds Inlet Concentration	3-5 mg/m3 (assumed)
Siloxanes Outlet Concentration	<0.1 PPMV
Media	Pelletized activated carbon or comparable media

A single combined-heat-and-power system (CHP) will be installed to run on conditioned digester gas. It is assumed that the generator of the CHP will be driven by a reciprocating internal combustion engine. The CHP will include heat exchangers that recover heat from the engine jacket and exhaust and transfer it to the digester heating system via the primary hot water loop. CHP will be furnished with synchronizing controls to operate in parallel with the plant power distribution system. The design criteria for the CHP equipment is displayed in Table 6.45.

The plant electrical system will be furnished with protective devices at the service entrance circuit breaker in accordance with the electric utility's interconnection requirements. The electric utility interconnection requirements will be coordinated with the electric utility as early as possible into the project design.

Table 6.45. Design Criteria for the Combined Heat and Power Equipment

Design Parameter	Value
Quantity	1
Electrical Output	335-400 kW at 480 VAC
Fuel Input	3.0-3.3 MMBTU/HR
Fuel Input Pressure (Regulated)	1-2.9 psig
Heat Recovery	Jacket and Engine Exhaust
Total Heat Recovery	>1.1 MMBTU/HR
Style	Pre-Packaged, Sound-Attenuated Enclosed Unit
Cooling System	Air-to-Water Radiators

Modifications to Existing Cake Storage with Offsite Cake Solids Receiving

Dewatered cake storage facilities are currently located at the SWWTP. Dewatered cake storage suitable for up to 30-days storage based on average residuals production rates is recommended under state regulatory requirements for the Residuals Management Plan unless special permission is received from the Director of the Division of Water Quality.

No changes will be made to the existing cake storage facility at this point.

Septage/Vactor Truck Receiving Station

A septage receiving and handling station is proposed for the SWWTP upgrades to accommodate the receipt and handling of off-site generated septage flows. The proposed septage receiving and handling station will include septage screening; grit removal; and floatable fats, oils, and grease removal.

The vactor truck station will allow for receipt and handling of the contents of vactor trucks, including collection system debris. The station will allow the removal of debris from septage brought to the plant. The removed debris will be compacted and placed in a dumpster for landfill disposal. The liquid underflow from the septage will be pumped using the filtrate pump station back to the preliminary treatment facilities. Table 6.46 summarizes the design criteria for the septage receiving station.

Table 6.46. Septage Receiving Station Design Criteria

Design Parameter	Value
Septage Receiving Units	
Number of Units	1
Manufacturers	Huber and Enviro-Care
Hydraulic Capacity (gpm) at 5% solids	400

Five concrete unloading pads (bays) will be provided, each with dimensions 15 ft width by 40 ft length, for the placement of vacuum truck contents. The concrete will be sloped from the center of each bay (which will be the highest point) along the width for the draining of liquid. The back wall will serve as a push wall for a front loader that will be used for removal of solids. Open trench drains will be provided along the length of each bay on both sides which will allow for easier

washdown. Liquid entering the drains will be directed to the filtrate pump station which will pump contents back to the preliminary treatment facility.

Odor Control Facilities

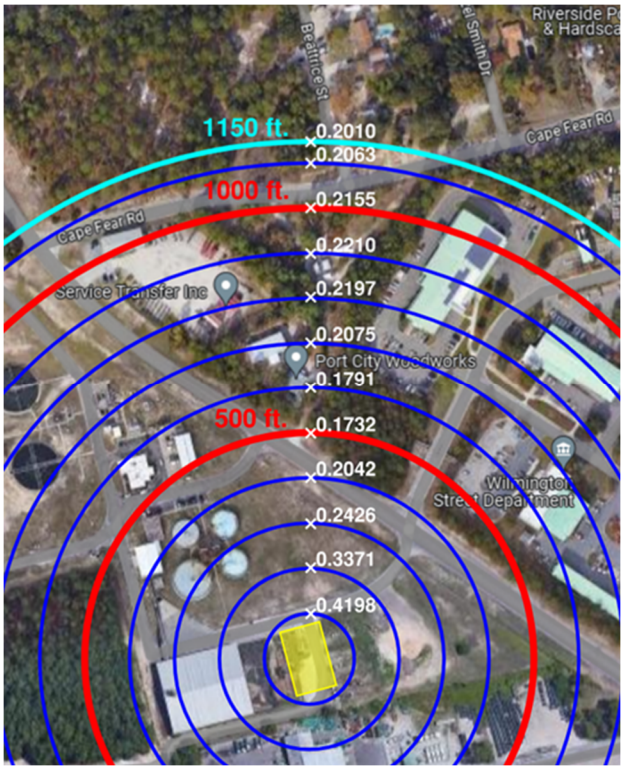
It is recommended that a new odor control facility be provided to treat odors from the screenings and grit removal facility (SGRF) and the primary clarifier launders. The facility will consist of a biofilter followed by a carbon polishing step, including an estimated 13,000-cfm scrubber fan. Table 6.47 presents the design criteria for the odor control facility.

Table 6.47. Odor Control Design Criteria

Design Parameter	Value
Biofilter System	
Number of Units	1
Airflow Rate, Total (scfm)	13,000
Service	SGRF and Primary Clarifier Launders
Manufacturers	Biorem, ECS
Construction	Concrete vessel
Inlet H2S Concentration, Average (ppm)	20
Inlet H2S Concentration, Peak (ppm)	100
Average Total Reduced Sulfur Compounds, (ppm)	2
Peak Total Reduced sulfur compounds, (ppm)	5
Design H_2S Removal, minimum	99.0%
Total Odor Removal Efficiency, Minimum	90.0%
Minimum Detention Time in Biofilter Media, seconds	45
Humidifier Diameter, ft	8
Humidifier Recirculation Pump, HP	5
Exhaust Fan	
Number of Units	1
Exhaust Fan Design Capacity (scfm)	13,000
Exhaust Fan Horsepower	50
Drive	VFD
Carbon Adsorber	
Number of units	1
Type	Upflow, Dual Bed
Airflow Rate, Total (scfm)	13,000
Diameter, ft	12
Manufacturers	ECS, PureAir, Daniel
Inlet H2S concentration, average (ppm)	1.0
Inlet H2S, peak (ppm)	5.0
Average Total Reduced Sulfur Compounds, (ppm)	1.0
Peak Total Reduced sulfur compounds, (ppm)	2.0
Removal efficiency (H_2S), minimum (%)	99.5
Minimum Empty Bed Contact Time (EBCT), seconds	3.0
Minimum Carbon Bed Depth, ft	3.0

The need for an odor control system for the biosolids dewatering building was evaluated using an odor dispersion model software, SCREEN View. The model evaluated two scenarios, the first assuming no exhaust fans are installed on the roof of the building, while the second assumed fans are in use. The goal of the evaluation was to assess if fans can help decrease the concentration of hydrogen sulfide (H_2S) to around 0.1 ppm, which is the odor detection threshold, at the nearest residential areas.

The model showed that the use of high plume dilution exhaust fans decreased the concentration of H_2S detected by nearly 50% at the point of interest (1150 feet from building). Figure 27 and Figure 28 show the concentration of H_2S at increments of 100 feet away from the biosolids dewatering building. These results show that an odor control system is not needed if an odor dispersion system is provided.



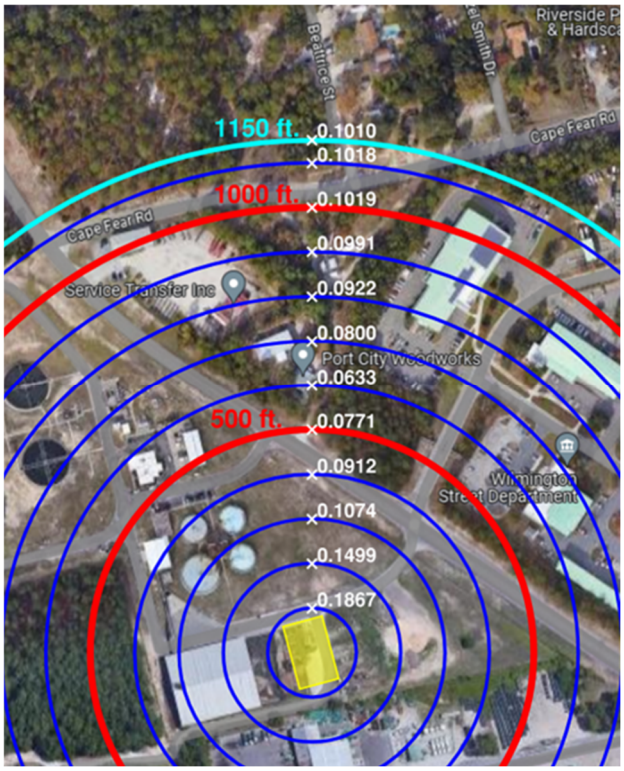


Figure 27. Concentration Dispersion w/o Fan **Figure 28. Concentration Dispersion w/ Fan**

An odor dispersion system consisting of three exhaust fans will be provided to decrease the concentration of H_2S that reaches the nearby residents. Fan parameters for the odor dispersion system are shown in Table 6.48 below.

Table 6.48. Odor Dispersion Fan Parameters

Exhaust Fan Design Parameters	Value
Make	Greenheck, Strobic, or equal
Model	Vektor-CD, Tri-Stack, or equal
Number of Units	3
System Setup	2 duty + 1 standby
Airflow Rate (cfm)	14,250
Windband Exit Airflow Rate (cfm)	21,375
Dilution Ratio (%)	150
External Static Pressure (“WG)	1.65
Windband Area (ft^2)	5.53
Motor Size (hp)	15
Drive	Direct
Electrical Connection (Voltage/Phase/Frequency)	480/3/60
System Weight (lbs)	3,990
Appx. Dimensions – H x W x L (ft)	10.5 x 9 x 16

Chemical Storage and Feed Facilities

It is recommended that two new chemical storage and feed facilities be provided for several wastewater process applications. A new sodium hydroxide (caustic) storage and feed system will provide means for alkalinity adjustment at the screenings and grit removal facility, although models have indicated that there will be minimal demand. The caustic facility will be located south of the new secondary clarifiers, adjacent to the new screenings and grit removal facility where it will be fed. A new sodium hypochlorite storage and feed facility will provide RAS chlorination as needed to manage sludge bulking and disinfection for the non-potable water (NPW) pump station. The sodium hypochlorite facility will be located east of the new UV disinfection facility near the NPW pump station and the RAS chlorination injection vault. Additionally, it is recommended that space be reserved on the site for a future supplemental carbon feed facility if it is required for nitrogen removal in the biological nutrient removal (BNR) basins. A future space has been allocated on the site to the east of future BNR basins.

Table 6.49 details the design criteria for each facility. Bulk storage tanks will be sized to cumulatively store the required days of storage as detailed in the table. At a minimum, each bulk storage tank will be sized to hold 150% of the delivery volume (if this volume is larger than the days of storage volume).

Table 6.49. Chemical Storage and Feed Facilities Design Criteria

Design Parameter	Value	
Sodium Hydroxide Storage and Feed		
Application	Screenings and Grit Removal Facility	
Solution Concentration	25%	
Bulk Storage Tanks		
Days Storage	30 days at Max Month	
Number	2	
Useable Capacity per Tank	11,000 gal	
Type	Vertical Cylinder, Cross-Linked Polyethylene	Vertical Cylinder, Fiber Reinforced Plastic
Manufacturers	Poly Processing, Snyder, Assmann	Justin Tanks, Plas-Tanks Industries, Belco Manufacturing, Diamond Fiberglass
Transfer Pumps		
Number	2 (1 duty / 1 standby)	
Type	Magnetic Drive Centrifugal	
Manufacturers	ANSIMAG, INNOMAG	
Horsepower	3	
Metering Pumps		
Number	2 (1 duty / 1 standby)	
Type	Mechanically Actuated Diaphragm	
Manufacturers	Sigma by ProMinent, or equal	
Horsepower	< 1	
Maximum Feed Rate	75 gph	
Sodium Hypochlorite Storage and Feed		
Applications	RAS Chlorination, NPW Pump Station	
Solution Concentration	15% trade	
Bulk Storage Tanks		
Days Storage	RAS Chlorination: 7 days at Average MLSS, Max Dose; 2 days at Max MLSS, Average Dose NPW: 30 days at Max Flow, Average Dose	
Number	1	
Useable Capacity per Tank	9,000 gal	
Type	Vertical Cylinder, Cross-Linked Polyethylene	Vertical Cylinder, Fiber Reinforced Plastic
Manufacturers	Poly Processing, Snyder, Assmann	Justin Tanks, Plas-Tanks Industries, Belco Manufacturing, Diamond Fiberglass
Transfer Pumps		
Number	2 (1 duty / 1 standby)	
Type	Magnetic Drive Centrifugal	
Manufacturers	ANSIMAG, INNOMAG	
Horsepower	3	

Design Parameter	Value
Metering Pumps	
Number	4 (2 duty / 2 standby)
Type	Mechanically Actuated Diaphragm
Manufacturers	Sigma by ProMinent, or equal
Horsepower	< 1
Maximum Feed Rate	125 gph (RAS Chlorination) 7 gph (NPW)
Future Supplemental Carbon Storage and Feed	
Application	BNR Tanks
Solution Concentration	Varies by product
Bulk Storage Tanks	
Days Storage	30 days at Max Month
Number	2
Useable Capacity per Tank	15,000
Type	304 Stainless Steel
Manufacturers	Modern Welding, General Industries, Highland Tanks
Transfer Pumps	
Number	2 (1 duty / 1 standby)
Type	Magnetic Drive Centrifugal
Manufacturers	ANSIMAG, INNOMAG
Horsepower	3
Metering Pumps	
Number[1]	5 (4 duty / 1 standby)
Type	Mechanically Actuated Diaphragm
Manufacturers	Sigma by ProMinent, or equal
Horsepower	< 1
Maximum Feed Rate	15 gph

[1]One per BNR basin. Number will increase if additional BNR basins are added in the future.

Each storage and feed facility will include secondary containment for the bulk storage tanks. It is recommended the sodium hypochlorite tank be located indoors to minimize degradation concerns that can occur when stored at higher concentrations and in warmer conditions. Alternatively, hypochlorite may be diluted to a lower concentration as it is delivered onsite and may be stored outdoors with minimal degradation concerns. However, more storage volume will be needed for a lower concentration. Additionally, the freezing temperature will be higher, and tanks will require heat tracing. Metering pumps for all chemical systems are recommended to be stored indoors to extend their useful life. The floor of each chemical room will slope down to a sump, provided with a level switch and sump pump, for pumping out spills or washdown water. Chemical rooms will be provided with emergency shower/eyewash stations and continuous ventilation. A translucent panel will be installed in the outside wall of chemical rooms to allow for removal and replacement of storage tanks.

Each facility will be provided with a mechanical room to house the tempered water system, sprinkler riser (as needed for indoor tank storage), backflow preventers for the water supply, and a sink for maintenance activities, and a separate electrical room will also be provided.

Generators

An electrical load list was created, detailing the plant loads for each proposed capacity increment. This list provides information used for the development of the proposed electrical distribution system. The load list is summarized in Table 6.50.

Table 6.50. Estimated Electrical Load per Capacity Upgrade

	Connected Load (kW)	Operating Load (kW)
16MGD Capacity	3,663	3,217
20MGD Capacity	4,739	4,021
24MGD Capacity	5,533	4,646

The operating load values shown in the load list are calculated by multiplying the connected load by a demand factor. The demand factor allows for the connected load values to be reduced to approximate a more realistic demand load. These demand factors also take into consideration the firm capacity of unit processes. Firm capacity is the installation of multiple units of equipment (e.g., pumps) to handle the design flow of the plant with the largest unit out of service.

As evidenced by Table 6.50, the estimated total plant load to be served by the plant's electrical power distribution system is 3,217 kW for 16 MGD capacity, 4,021 kW for 20 MGD capacity, and 4,646 kW for 24 MGD capacity. Industry wide, calculated loads are roughly 30%-50% higher than actual loads experienced in real world scenarios but these calculated loads are required by the National Electrical Code (NEC) to be used when determining equipment and wiring sizes for electrical equipment. Therefore, these values will be used at the individual equipment level to size the proposed switchgear, switchboards, motor control centers, and power panelboards throughout the facility.

Three medium voltage, diesel-fueled standby generator sets will be installed in parallel to provide standby power to the entire facility with N+1 reliability. The proposed generators will be located outside the main electrical building in individual weatherproof, sound attenuated enclosures. The generators will be EPA Tier 2 Emissions Certified suitable for emergency use only, no peak shaving or load curtailment will be allowed. The proposed standby generator sets were preliminarily sized at 2 MW based on the initial load study, providing a total operating capacity of 4 MW. The load study will be continuously updated throughout design, as a more detailed understanding of operation is determined, to confirm the generators are adequately sized to operate the entire facility. An additional space for a future third generator will be provided to meet additional load demand as the plant capacity expands.

Administration Building

The proposed administration building will contain staff quarters, showers, a breakroom, administrative offices, an observation room, and instrumentation and control rooms. The proposed building will be 95'x95'x30'. Forty parking spaces will surround the proposed building.

6.2 Proposed Project Design Details

The proposed treatment process of the proposed project was modeled in Biowin. Preliminary effluent characteristics from this model are included in Table 6.51.

Table 6.51. Biowin Effluent Characteristics

Parameter	Unit	16 MGD Annual Average	16 MGD Max Month	24 MGD Annual Average	24 MGD Max Month
Flow	mgd	16	16	24	24
Influent COD	mg/L	647	841	647	841
Influent BOD	mg/L	250	325	250	325
Influent TSS	mg/L	250	325	250	325
Influent TKN	mg/L	43.4	56.4	43.4	56.4
Influent NH3	mg/L	30.3	39.8	30.3	39.8
Influent TP	mg/L	7.1	9.2	7.1	9.2
Temperature	deg C	22.7	14	22.7	14
Basins In Service	#	3	4	5	6
MLSS	mg/L	3,122	3,467	2,796	3,567
Effluent BOD	mg/L	< 5	< 5	< 5	< 5
Effluent TSS	mg/L	< 10	< 10	< 10	< 10
Effluent NH3	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Effluent NO3	mg/L	11.2	17.4	12.2	19.7
Effluent TKN	mg/L	1.56	1.88	1.55	1.88
Effluent TN	mg/L	12.8	19.8	13.8	21.6
Effluent TP	mg/L	3.09	4.25	2.76	3.74

Section 7.0 Environmental Information Document

Table 7.1. Topography and Floodplains Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority			
Complete this table in accordance with Section 4.1.			
Floodplain Figure Reference Number (if applicable):			Figure 29 & Figure 30
Floodplain Information Appendix Reference (if applicable):			Appendix I
Existing Conditions			
Physiographic Province:	☒ Coastal Plain	☐ Piedmont ☐ Mountains	
Minimum Elevation in Project Area (MSL):		*Maximum Elevation in Project Area (MSL):*	
-2 ft.		50 ft.	
Is the project in the 100-year floodplain? (If so, show in Environmental Features Figure.)			☒ Yes ☐ No
Is the project in the 100-year floodway? (If so, show in Environmental Features Figure.)			☒ Yes ☐ No
Discuss other topographical and geological features.			
Adjacent to the Cape Fear River, the sites generally slope downwards from River Road to the river. There is a fill dirt pile located in the southeastern part of the project site that generally ranges from 10 to 15 feet above ground elevation.			
Impacts			
Describe construction impacts of project on topography.			
The project will permanently impact the topography in the immediate areas of the proposed structures. Any additional impacts to topography in the project area will be temporary to facilitate construction. Such temporary impacts include excavation for installation of subsurface utilities. These areas of temporary topography disturbances will be returned to existing, pre-construction conditions utilizing the mitigative measures described below.			
Describe impacts of project on the 100-year floodplain and floodway if "Yes" is checked above.			
The proposed project includes removing the existing UV disinfection channels, which are installed within the 100-year floodplain, and installing new UV disinfection channels outside of the 100-year floodplain. This will permanently benefit the 100-year floodplain, as these units will be removed outside of the floodplain. The proposed project also includes replacing the existing effluent discharge piping, which is within the 100-year floodplain and 100-year floodway, with larger piping. This will permanently impact the 100-year floodplain and 100-year floodway; however, there are no practical alternatives to situate the effluent discharge piping outside of these boundaries. Direct impacts associated with the construction of the new effluent piping will be minimized using the mitigative measures described below. It should be noted that the effluent discharge point will not change. The navigable channel within the Cape Fear River will not be impacted by the new discharge piping.			
Describe SCI of the project.			
An expanded WWTP could support additional population growth and development, which could alter the region's topography.			

Table 7.1. Topography and Floodplains Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority	
Mitigative Measures	
Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable
Describe the mitigative measures below and supply references to the appropriate appendix in the ER/EID.	
Mitigative Measure Description	*Reference(s)*
An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and the Cape Fear River to mitigate temporary impacts. A stormwater permit will also be obtained prior to construction. Stormwater infrastructure will be installed to mitigate permanent impacts to the topography. Most of the expansion site will likely not be re-graded to its original contours, as permanent impacts to the topography will be required to install some of the equipment of the proposed project. Regrading will be conducted in areas indicated in a future approved grading plan. The measures listed above will mitigate impacts to the topography and floodplain. Zoning laws and regulations enforced by the governing body will mitigate potential impacts caused by population growth and development.	Appendix I – City of Wilmington Land Development Code – Article 13. Floodplain Management



Figure 29. Topography Map

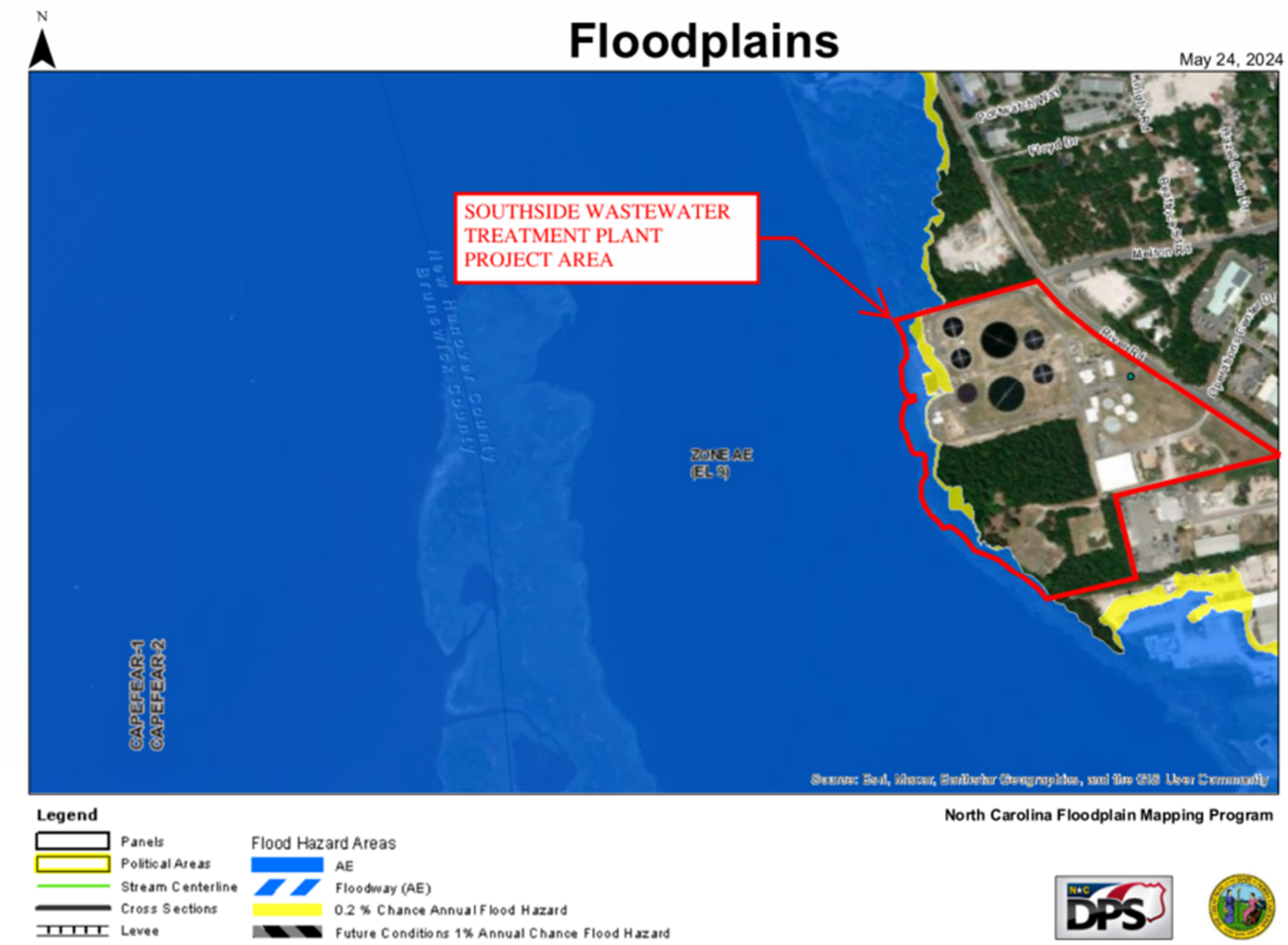


Figure 30. Floodplain Map

Table 7.2. Soils
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table in accordance with Section 4.2.

Soils Figure Reference Number:	See figure on page 9 of Appendix J
Soils Information Appendix Reference (if applicable):	Appendix J & Appendix K

Existing Conditions

Describe the types of soil. Provide a soils figure in the EID.

Approximately 25 acres of land is anticipated to be disturbed at the WWTP site. According to the USGS soil report of the 41.1-acre WWTP parcel, the soil in the project area consists of Baymeade fine sand (1.9 acres), Kureb sand (3.1 acres), Lakeland sand (13.4 acres), Urban land (21.9 acres), and Water (0.7 acres). It should be noted that no work will occur in the water. Specific soil classifications and descriptions are as follows:

- Baymeade fine sand (Be), 1 to 6 percent slopes, is characterized as a well-drained soil located on ridges on marine terraces. Very low water capacity and rapid permeability are the main limitations in the use and management of this soil. The seasonal water table is at a depth of more than 6 feet. Due to the high permeability and low organic content, the establishment of vegetative cover is a potential constraint within the project areas that require vegetative stabilization.
- Kureb sand (Kr), 1 to 8 percent slopes, is characterized as an excessively drained soil located on rims on Carolina bays and ridges on marine terraces. Very low available water capacity and rapid permeability are the main limitations in the use and management of this soil. The seasonal high-water table is at a depth of more than 6 feet. Due to the high permeability and low organic content, the establishment of vegetative cover is a potential constraint within the project areas that require vegetative stabilization.
- Lakeland sand (La), 1 to 8 percent slope, is characterized as excessively drained soil located on ridges on marine terraces. Very low water capacity and rapid permeability are the main limitations in the use and management of this soil. The seasonal water table is at a depth of more than 6 feet. Due to the high permeability and low organic content, the establishment of vegetative cover is a potential constraint within the project areas that require vegetative stabilization.
- Urban land (Ur) is characterized as impervious surfaces that increase the amount of runoff.

Is soil contamination present?	☒ Yes	☐ No
Does soil type present any constraints to the project?	☐ Yes	☒ No

If yes to either of the above, explain:

The WWTP expansion will be constructed on an adjacent property that has been acquired by CFPUA. This adjacent parcel was previously used as a shooting range for the Wilmington Police Department. S&ME performed soil and groundwater sampling at the Wilmington Police Department firing range on September 19 and 20, 2013. The finding at the site are as follows:

- Shells, casings, and other debris typically associated with firearm discharge were observed on the ground surface of the shooting range yard and in the soil berm (as shown in Appendix K).
- Laboratory analytical results of soil samples indicated the presence of five polycyclic aromatic hydrocarbons (PAHs) at concentrations above their respective preliminary soil remediation goals (PSRGs) in the soil berm. These include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene.
- Multiple other PAHs were detected at concentrations below their respective PSRGs from the other samples.

Table 7.2. Soils
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

- Lead was detected at concentrations that exceeded the Inactive Hazardous Sites Branch (IHSB) PRSG for industrial sites, residential site PRSG and/or Protection of Groundwater PSRG from several samples collected from the soil berm.
- Lead was detected at concentrations below PSRGs from samples collected from the parking lot, the shooting range yard, and the ammunition disposal area.
- Laboratory analytical results of groundwater samples indicated the presence of lead and two PAHs, naphthalene and 2-methylnaphthalene, at concentrations below their respective 2L Groundwater Standards.

Impacts

Will soil be moved offsite?	☐ Yes ☒ No	*Quantity (yd^3):*	N/A
Will soil be contaminated?	☐ Yes ☒ No		

Describe construction impacts of project.

Direct impacts from construction are anticipated to be minimal. Most of the project components that are new or need to be replaced are above grade. Most of the anticipated soil disturbances will occur during construction of the pump stations and structural foundations for WWTP components. Where applicable, the appropriate stormwater infrastructure improvements will be provided, as required by the local and State regulations to provide the appropriate grading and drainage on the project site.

If unsuitable soil is encountered during construction, the Contractor will be responsible for moving and disposing of that soil in accordance with all applicable regulations. The Contractor will also be required to use fill to replace the unsuitable soils for construction.

Describe SCI of the project.

An expanded WWTP could support additional population growth and development, which could alter the region's soils.

Mitigative Measures

Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable

Describe the mitigative measures below and supply references to the appropriate appendix in the ER/EID.

Mitigative Measure Description	*Reference(s)*
An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Mineral and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls will be installed and maintained between the construction site and the Cape Fear River. If encountered during construction, contaminated soil will be removed from the project site and disposed of by the Contractor. If the shooting range yard is to be used for contractor lay-down area during construction, it is recommended that the ground surface and berm be isolated from each other to avoid soil contact with contractor personnel, per Appendix K. As required, containment action plans will be developed by a	Appendix K Erosion and Sedimentation Control Plan (to be applied for by Contractor)

Table 7.2. Soils Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority	
subconsultant with extensive experience with contaminated sites in this region. Secondary and cumulative impacts shall be mitigated by adhering to project specific state approved erosion and sedimentation control plans.	

Table 7.3. Prime and Unique Farmland Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority			
Complete this table in accordance with Section 4.3.			
Prime and Unique Farmland Information Appendix Reference (if applicable):			Figure 31
Existing Conditions & Impacts			
1) Does the project area contain prime and unique (P&U) farmlands? If yes, show on soils figure the soil types that are prime and unique farmland. (If "No" skip the rest of the table.)	☐ Yes ☒ No	If Yes, Quantity (acres):	N/A
2) Will P&U farmland be directly impacted by the project? (If "No" skip questions 3-4.)	☐ Yes ☒ No	If Yes, Quantity (acres):	N/A
3) *What is the total acreage of P&U farmland in the county?*	Acres Impacted:	N/A	
4) What is the percentage of P&U farmland in the county that will be impacted? (Divide answer to Question 2 by answer to Question 3)	Percentage Impacted:	N/A	
Will SCI impact prime and unique farmlands?	☐ Yes ☒ No	If Yes, Quantity (acres):	N/A
Describe SCI of the project.			
An expanded WWTP could support additional population growth and development, which could affect prime and unique farmland in the region.			
Mitigative Measures			
Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*		
☐ Yes ☒ Not Applicable	☒ Yes ☐ Not Applicable		
Describe the mitigative measures below and supply references to the appropriate appendix in the ER/EID.			
Mitigative Measure Description	*Reference(s)*		
City of Wilmington zoning laws and regulations will mitigate potential impacts caused by regional population growth and development. Future developers shall coordinate with the NCRS to determine if proposed projects will adversely affect prime and unique farmlands.	Appendix L		

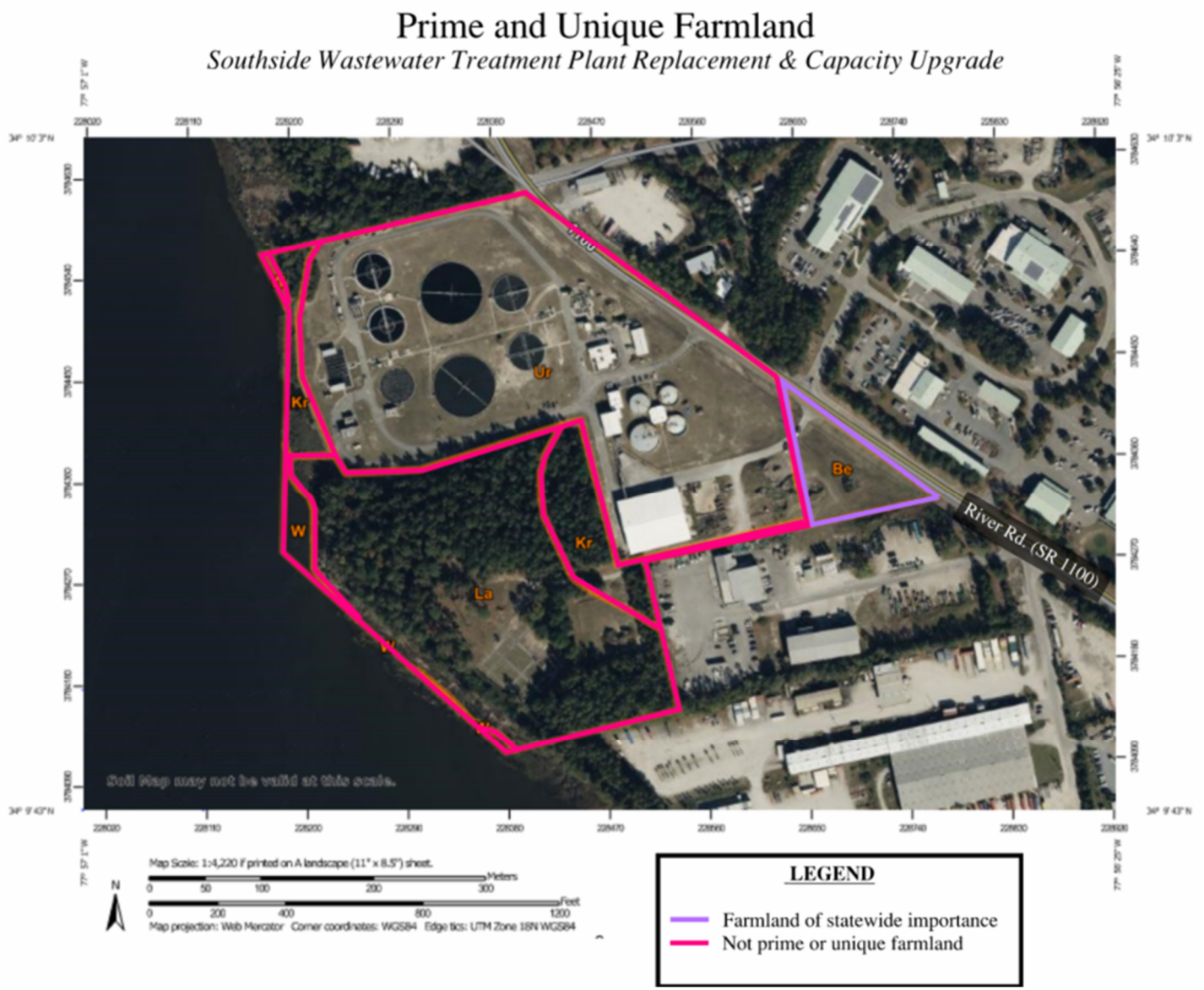


Figure 31. Prime and Unique Farmland Map

Table 7.4. Land Use **Southside WWTP Replacement & Capacity Upgrade** **Cape Fear Public Utility Authority**	
Complete this table in accordance with Section 4.4.	
Land Use Figure Reference Number (if applicable):	Figure 32 & Figure 33
Land Use Information Appendix Reference (if applicable):	N/A
Existing Conditions	
Discuss the current land use for the project site.	
The existing WWTP is situated on an industrially zoned parcel. The newly acquired parcel (that was previously a shooting range for the Wilmington Police Department) is also an industrially zoned parcel.	
Discuss the current land use for the project area.	
The current land use for the project area is general industrial.	
Discuss the zoning for the project site.	
The zoning for the project site is general industrial.	
Discuss the zoning for the project area.	
The surrounding project area is zoned as a combination of general industrial and commercial services.	
Impacts	
Discuss the direct impacts to land use on the project site.	
The land use of the project site will remain the same. No direct impacts are anticipated.	
Describe SCI of the project.	
An expanded WWTP could support additional population growth and development, which could alter the land use of the region.	
Mitigative Measures	
Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☐ Yes ☒ Not Applicable	☒ Yes ☐ Not Applicable
Describe the mitigative measures below and supply references to the appropriate appendix in the EID.	
Mitigative Measure Description	*Reference(s)*
City of Wilmington zoning laws and regulations will mitigate potential impacts caused by regional population growth and development.	Appendix L

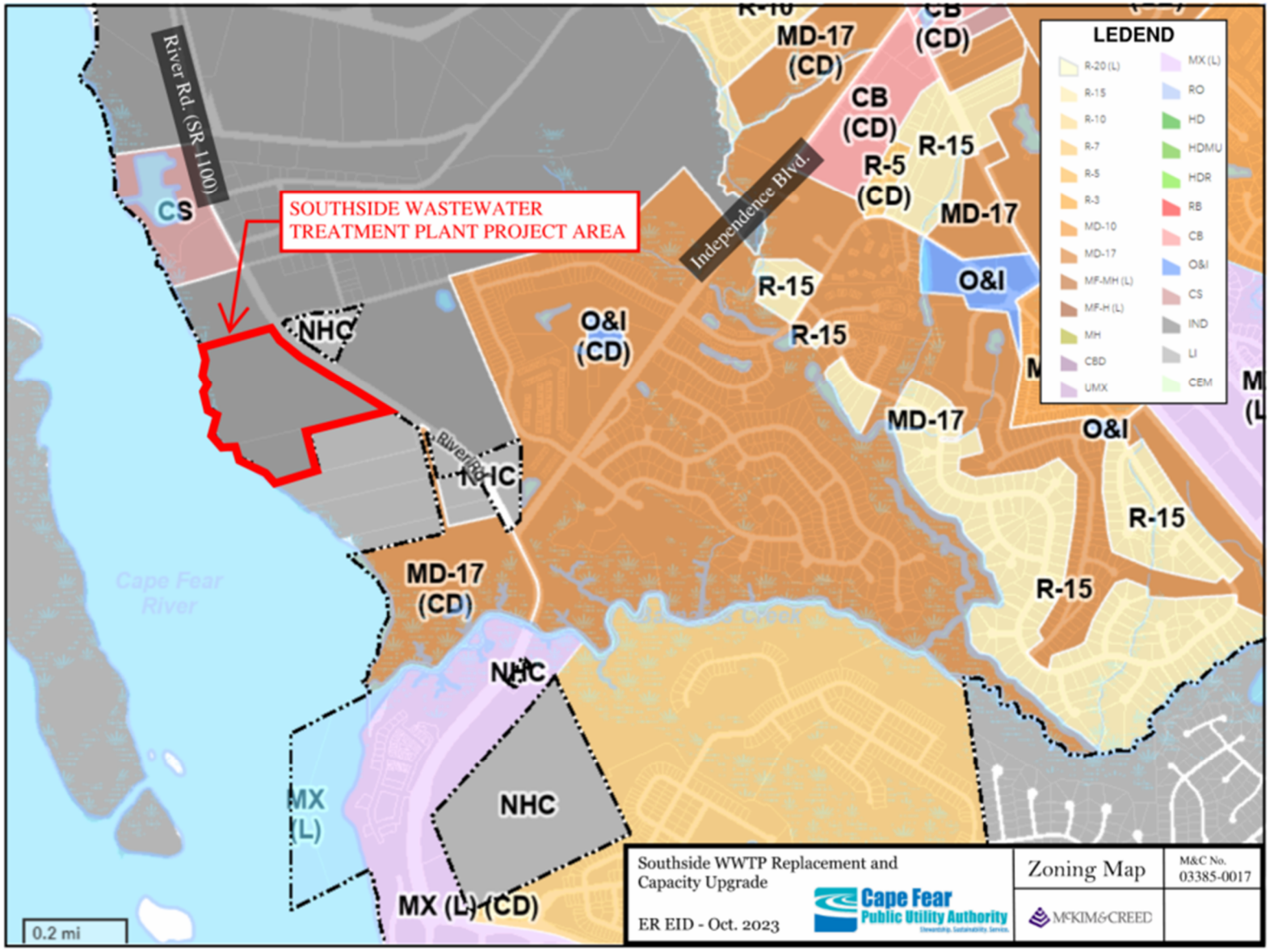


Figure 32. City of Wilmington Zoning Map

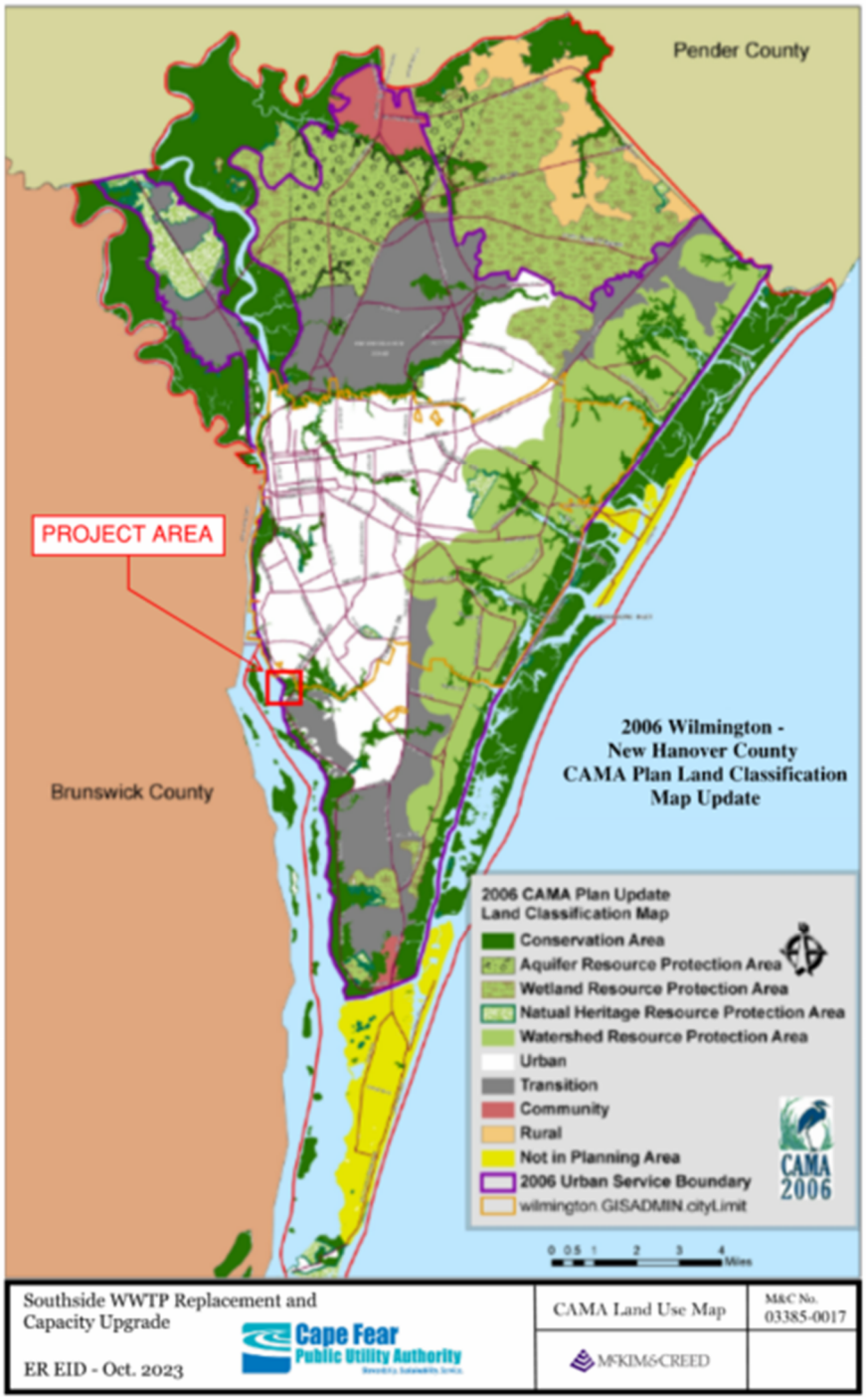


Figure 33. CAMA Land Use Map

Table 7.5. Forest Resources **Southside WWTP Replacement & Capacity Upgrade** **Cape Fear Public Utility Authority**			
Complete this table in accordance with Section 4.5.			
Forest Resources Information Appendix Reference (if applicable):			Figure 34 and Appendix M
Existing Conditions			
Discuss the type of forest resources on the project site and in the project area			
The existing WWTP site was previously cleared and has no forest resources; however, the new expansion will require clearing wooded areas adjacent to the existing WWTP site.			
Discuss the types of wildlife habitat on the project site and in the project area.			
The existing WWTP site includes little wildlife habitat (see Figure 34); however, due to the expansion, approximately 7 acres of wooded land will require clearing. Such clearing may have an impact on the wildlife habitat within these wooded areas. Types of wildlife habitat within the project site and in the project area include forests and wetlands.			
Impacts			
Will forest resources be impacted?	☒ Yes ☐ No	If Yes, Quantity (acres):	7
Will SCI impact forest resources?	☒ Yes ☐ No	If Yes, Approximate Quantity (acres):	Unknown
Describe SCI of the project.			
An expanded WWTP could support additional population growth and development, which could alter forest resources of the region.			
Mitigative Measures			
Mitigative Measures for Construction Impacts?		*Mitigative Measures for SCI?*	
☒ Yes ☐ Not Applicable		☒ Yes ☐ Not Applicable	
Describe the mitigative measures below and supply references to the appropriate appendix in the EID.			
Mitigative Measure Description			*Reference(s)*
All requirements set forth in the latest version of the Code of Ordinances of the City of Wilmington will be followed to mitigate negative impacts to regional forest resources caused by the proposed project. An approved tree removal permit will be required prior to commencement of construction.			Appendix M & Appendix N

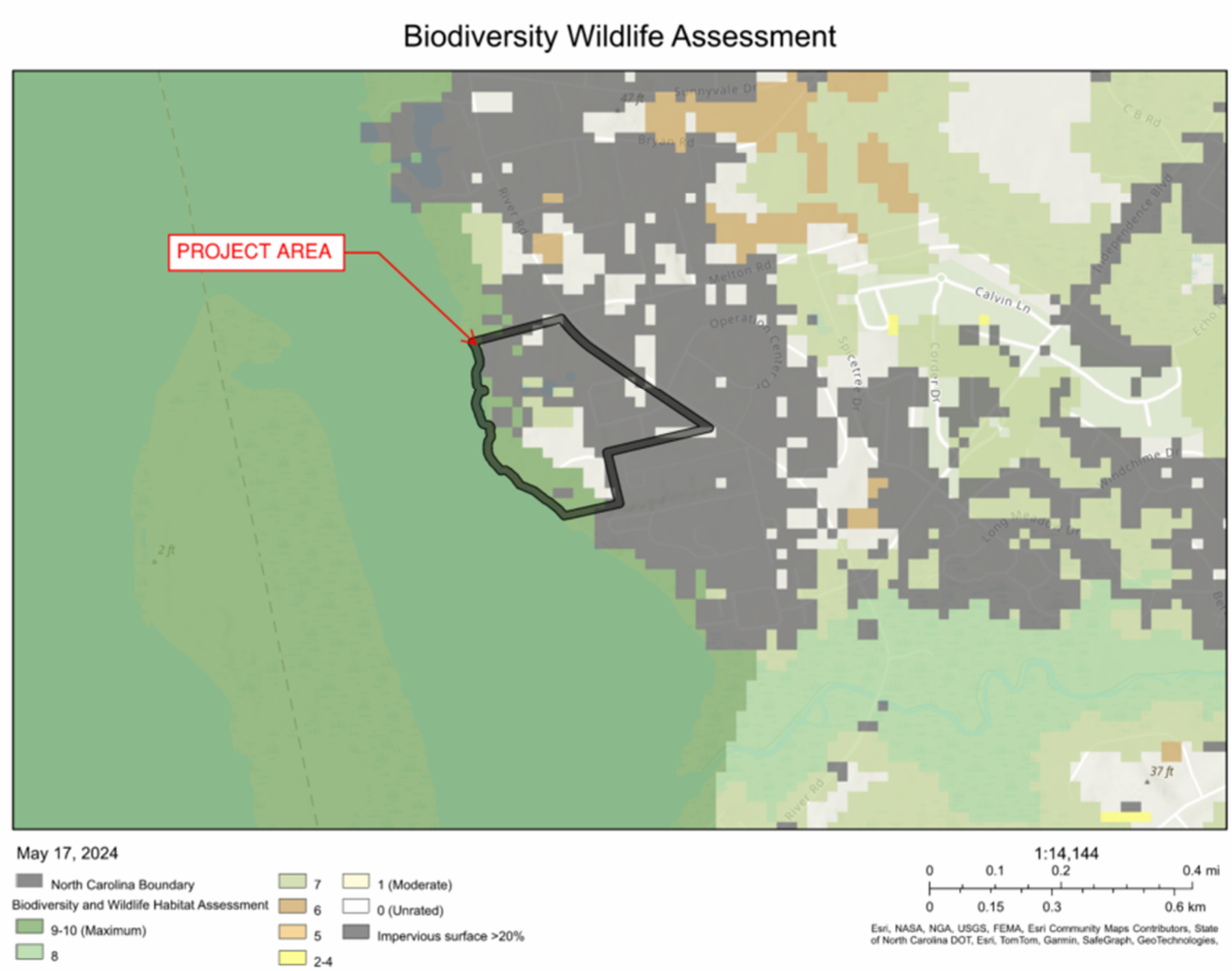


Figure 34. Biodiversity Wildlife Assessment Map

Table 7.6.1. Wetlands and Streams
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table in accordance with Section 4.6 of the guidance.

Wetlands and Streams Figure Reference Number:	Figure 35, Figure 36, & Figure 37
Wetlands and Streams Information Appendix Reference (if applicable):	Appendix O

Existing Conditions

Are wetlands present on the project site and in the project area?	*Are streams present on the project site and in the project area?*
☒ Yes ☐ No	☒ Yes ☐ No

If so, discuss the type, quality, function, and relative importance of wetlands and identify any streams.

Wetlands are located within the project site and within the project area. The project site is adjacent to the Cape Fear River (classified SC, Stream Index 18-(71)a3) and there are 404 wetlands and coastal wetlands located along the edge of the river, as shown in the referenced figures. There are no streams within the project site; however, there are streams located within the project area, specifically Barnards Creek (classified C;Sw, Stream Index 18-80) which is a tributary to the Cape Fear River. There are wetlands surrounding Barnards Creek.

Have delineations occurred?	*If so, supply the date.*
☒ Yes ☐ No	6/10/2021

Impacts

Will wetlands be impacted?	☐ Yes ☒ No	If Yes, Quantity (acres):	N/A
Will streams be impacted?	☐ Yes ☒ No	If Yes, Quantity (linear feet):	N/A
Will SCI impact wetlands?	☐ Yes ☒ No	If Yes, Approximate Quantity (acres):	N/A
Will SCI impact streams?	☐ Yes ☒ No	If Yes, Approximate Quantity (linear feet):	N/A

Describe Direct Impacts of the project (construction and operational impacts). If there will be any stream/wetland crossings, complete Table S.9.a in addition to the description.

Sedimentation and runoff from construction activities on the WWTP site could affect water quality in the surrounding wetlands and river; however, local floodplain ordinance and erosion and sedimentation control measures will be sufficient to mitigate the potential impacts.

The effluent discharge location will remain at the currently permitted side-stream discharge location to the Cape Fear River. Improvements will be necessary to expand the discharge capacity to accommodate the expanded facility. Direct impacts associated with the construction of the discharge force main improvements will be kept to a minimum and no permanent impacts are anticipated.

Describe SCI of the project.

Sedimentation and runoff from construction activities associated with increased development within the WWTP service area resulting from capacity expansion of the treatment plant could affect the water quality of surrounding wetlands and streams. However, it is anticipated that local floodplain ordinance and erosion and sedimentation control measures will be sufficient to mitigate the potential secondary and cumulative impacts.

Table 7.6.1. Wetlands and Streams Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority	
Mitigative Measures	
Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable
Describe the mitigative measures below and supply references to the appropriate appendix in the EID.	
Mitigative Measure Description	*Reference(s)*
An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and wetlands and the Cape Fear River. A stormwater permit will also be obtained prior to construction. Additionally, a USACE Section 404 and CAMA permit will be applied for upon substantial completion of construction drawings. It will be noted on final plans that all conditions of these permits will be adhered to during construction. It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.	Appendix O – New Hanover County, NC – Unified Development Ordinance – Article 8: Erosion and Sedimentation Control

Table 7.6.2. Stream/Wetland Crossings			
Southside WWTP Replacement & Capacity Upgrade			
Cape Fear Public Utility Authority			
For use with the CWSRF, WW-SRP, and WW-SEL programs.			
Wetland Crossings (add rows as needed; include all crossings even if impact is zero acres.)			
Stream and Wetlands Crossing Figure Reference Number:			N/A
Stream and Wetlands Crossing Information Appendix Reference (if applicable):			N/A
# Keyed to Map	Diameter & Type of Sewer	Installation Method	Acres Impacted
N/A	N/A	N/A	N/A
Total Wetland Impacts (acres):			**0**
Stream Crossings (add rows as needed; include all crossings even if impact is zero feet.)			
# Keyed to Map	Diameter & Type of Sewer	Installation Method	Linear Feet Impacted
N/A	N/A	N/A	N/A
Total Stream Impacts (feet):			**0**

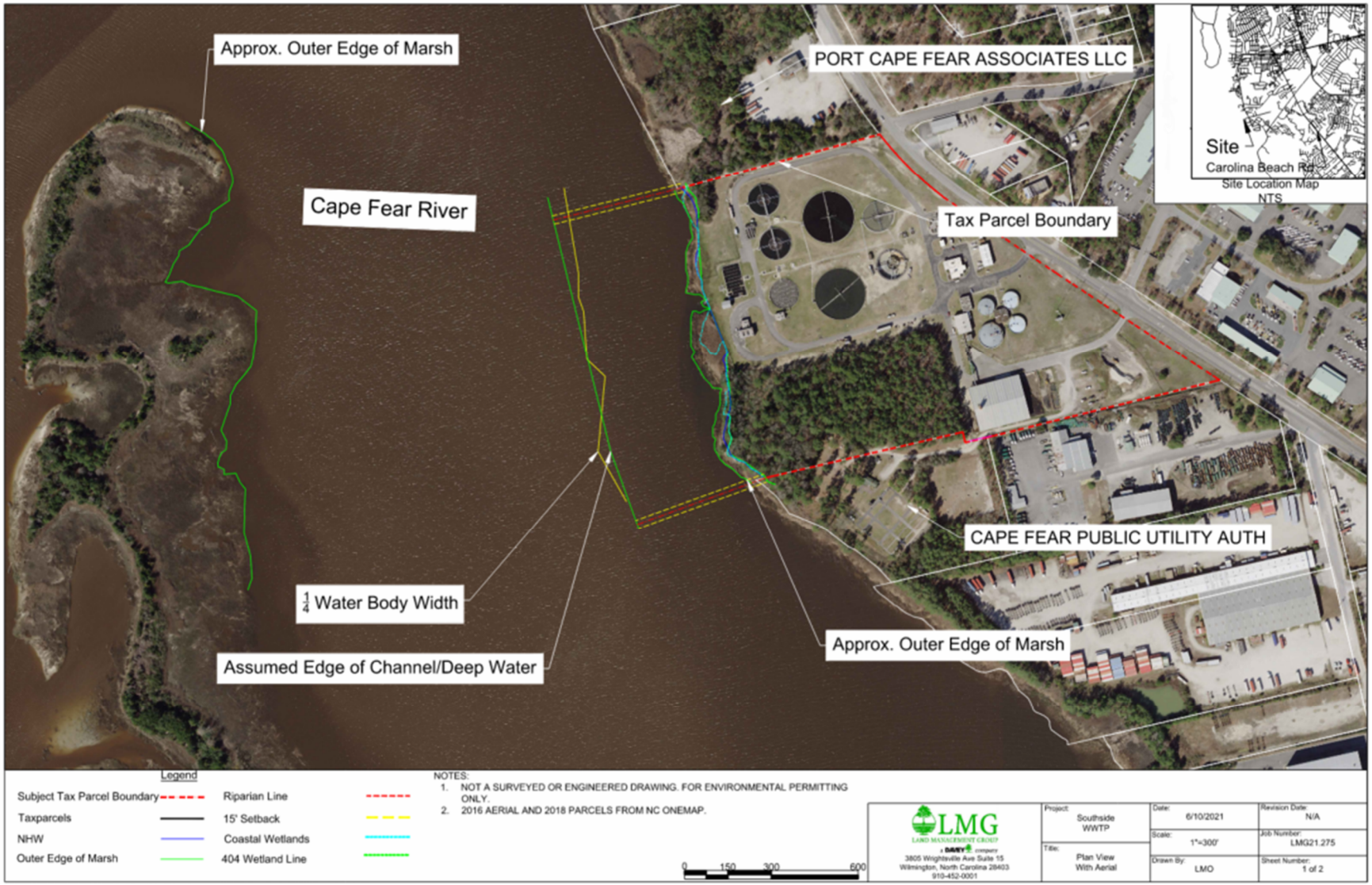


Figure 35. LMG Cape Fear River Channel Map – Plan View with Aerial

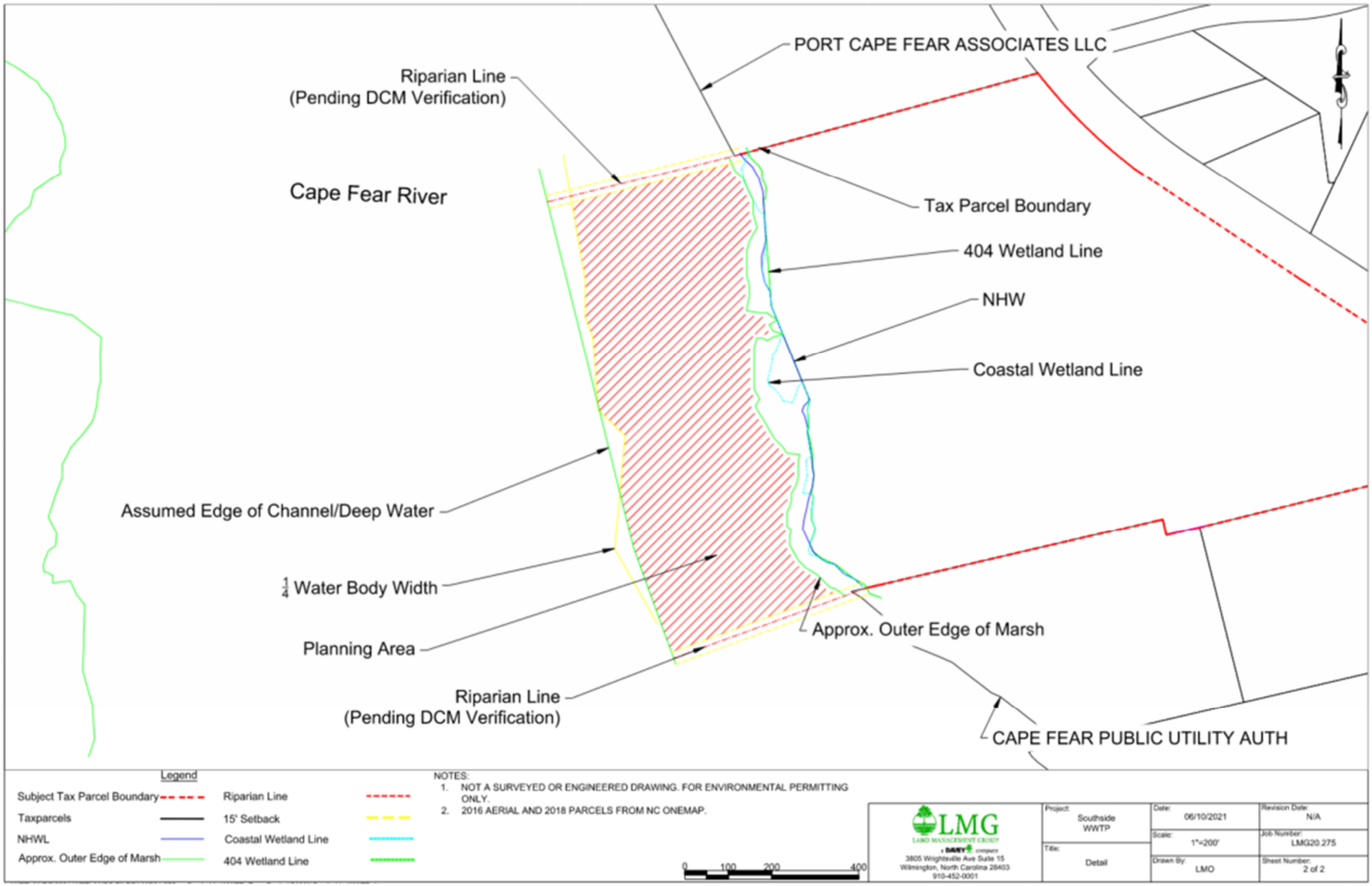


Figure 36. LMG Cape Fear River Channel Map – Detail

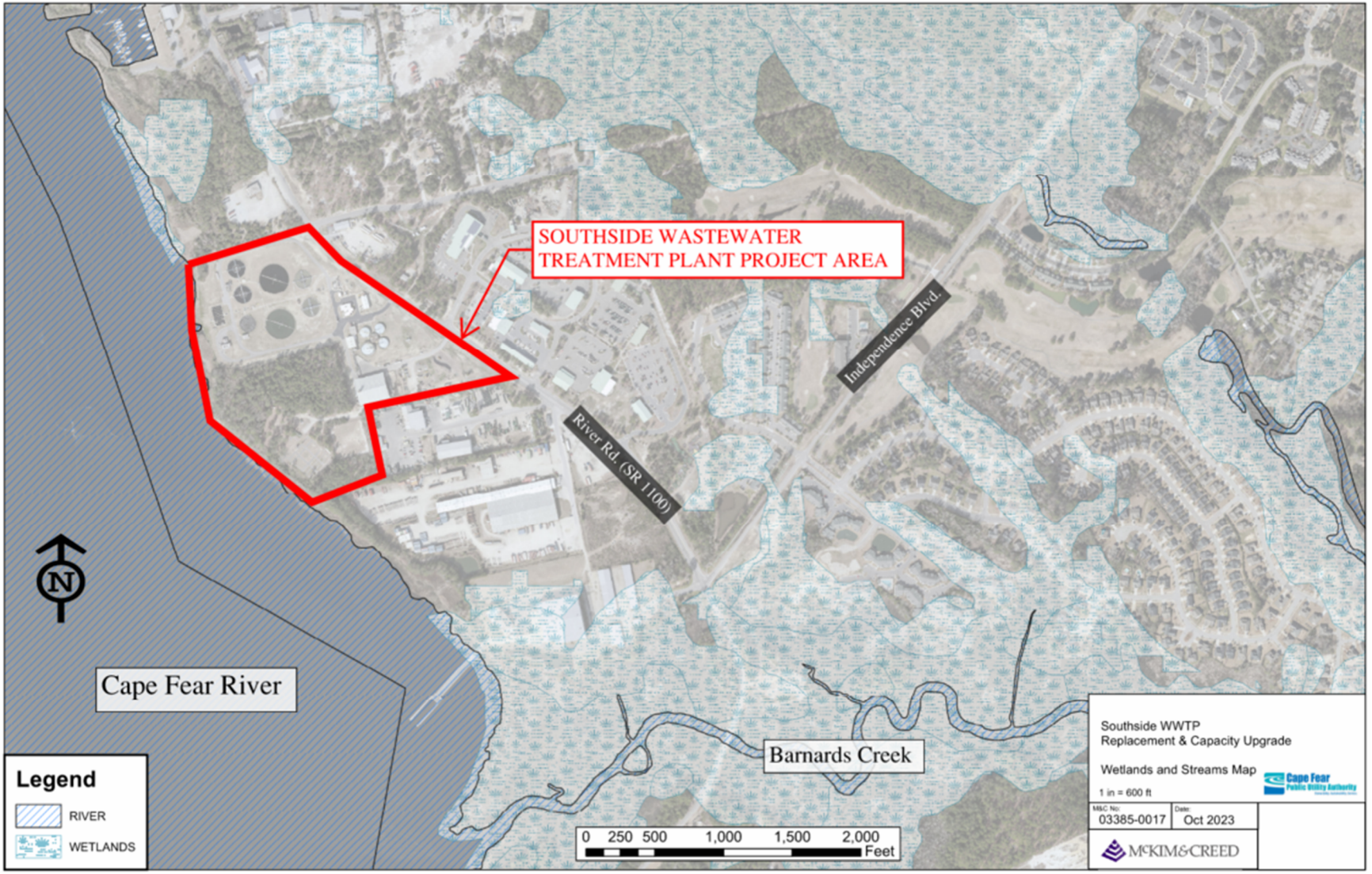


Figure 37. Wetlands and Streams Map

Table 7.7. Water Resources
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table in accordance with Section 4.7.

Water Resources Appendix Information Appendix Reference (if applicable):	Appendix P

Existing Conditions

River basin(s) for project:	Cape Fear

List all stream(s) found within the project site and greater project area.

Name	*Classification*	*Impaired?*	*Reason for Impairment*
Cape Fear River	SC	☒ Yes ☐ No	Dissolved Oxygen (5 mg/L, AL, SW)
Barnard's Creek	C; Sw	☐ Yes ☒ No	N/A

Discuss groundwater quality and quantity.

Groundwater in the area is supplied by the Castle Hayne, Pee Dee, Black Creek, Lower Cape Fear, and Upper Cape Fear aquifers. The Castle Hayne and Pee Dee aquifers are the main sources of groundwater in the central to southeastern portion of the coast.

The Pee Dee aquifer is present in the central to southeastern portion of the coastal plain at elevations of 114 to -1,842 feet, averaging -168 feet. The Pee Dee aquifer ranges from 2 to 1,001 feet thick and averages 142 feet thick. The aquifer is composed of fine to medium sand. Wells typically yield up to 200 gallons per minute.

The Castle Hayne aquifer is widely used in the eastern portions of the coastal plain at elevations from 65 to -1,091 feet, averaging -143 feet. The Castle Hayne aquifer ranges from 6 to 1,105 feet thick and averages 165 feet thick. The aquifer is composed of limestone, sandy limestone, and sand. It is the most productive aquifer in North Carolina. Wells typically yield 200-500 gallons per minute but can exceed 2,000 gallons per minute.

Table 7.7. Water Resources
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Discuss surface water quality.

The Cape Fear River Basin is the largest river basin in North Carolina and is located entirely within the state. It can be characterized by three distinct regions including the upper Cape Fear (the headwaters in the Piedmont), the middle Cape Fear (the fall line and the Sandhills region), and the lower Cape Fear (the coastal region including blackwater streams, peatlands, and swamps). The proposed project sits in the lower Cape Fear region of the Cape Fear River Basin. The Cape Fear River flows southeast across the Piedmont, through Fayetteville, and through the Sandhills and Coastal Plain regions before reaching Wilmington and the Atlantic Ocean.

The only tributaries in the greater project area are the Cape Fear River and Barnard's Creek. The Cape Fear River is classified as Class SC waters by the State. Class SC waters are tidal salt waters protected for secondary recreation such as fishing, boating, and other activities involving minimal skin contact; fish and noncommercial shellfish consumption; aquatic life propagation and survival; and wildlife.

Barnard's creek is classified as Class C and Sw water by the State. Class C waters are waters protected for uses such as secondary recreation; fishing; wildlife; fish consumption; aquatic life including propagation, survival, and maintenance of biological integrity; and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. Class Sw is a supplemental classification intended to recognize those waters which have low velocities and other natural characteristics which are different from adjacent streams. Barnard's Creek flows into the Cape Fear River.

The Cape Fear River is listed in the 2022 North Carolina 303d List for exceeding the dissolved oxygen (DO) parameter at the SSWWTP discharge point and downstream of the SSWWTP discharge point (Appendix Q). The listed assessment units (AU) related to these locations are 18-(71)a3, 18-(71)a4, and 18-(71)a5, which are shown in Figure 38, Figure 39, and Figure 40, respectively.

The Cape Fear River is also designated as a Fishery Nursery Area (FNA) and Primary Nursery Area (PNA) by the Division of Marine Fisheries (DMF), see Figure 41. PNAs, which are a subset of FNAs, are specific waters that reflect special water quality needs.

LGU water supply(ies):	The local government unit water supply for the proposed project area is the Cape Fear River. CFPUA and Lower Cape Fear Water and Sewer Authority maintain two separate raw water river intakes and pump stations that withdraw raw water in Bladen County, NC and convey it approximately 24 miles to southeastern NC, where it is treated and conveyed to customers.

Impacts

Discuss construction impacts related to surface water quality and groundwater quality/quantity.

Sedimentation and runoff from construction activities on the WWTP site could affect water quality in the surrounding wetlands and river; however, it is anticipated that local floodplain ordinances and erosion and sedimentation control measures will be sufficient to mitigate the potential impacts.

Table 7.7. Water Resources
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Discuss operational impacts related to surface water quality and groundwater quality/quantity.

No impacts to groundwater quality are anticipated because of the proposed project. The effluent water quality limitations and monitoring requirements set forth in Appendix D will be adhered to, as required by the State.

20 points were awarded for priority rating system item 2.O, as this project directly benefits sub watersheds that are impaired as noted on the most recent version of the Integrated report. 10 points were awarded for priority rating system item 2.P, as this project directly benefits specific classified waters. The proposed project will improve the water quality of the Cape Fear River. Modifying the treatment units of the SSWWTP from trickling filters to aeration basins is estimated to result in a load reduction of 358 lbs/day of oxygen consuming load. This oxygen consuming load reduction will result in a direct improvement to the DO in the impaired PNA designated receiving Cape Fear River. Additionally, modifying the treatment process, as detailed above, is estimated to result in a load reduction of at least 2,913 lbs/day of ammonia. This ammonia load reduction will also benefit the impaired receiving PNA designated Cape Fear River since ammonia exerts an oxygen demand through the nitrification process.

Describe SCI of the project.

Sedimentation and runoff from construction activities associated with increased development within the WWTP service area resulting from capacity expansion of the treatment plant could affect the water quality of surrounding surface water. However, it is anticipated that local floodplain ordinance and erosion and sedimentation control measures will be sufficient to mitigate the potential secondary and cumulative impacts.

Mitigative Measures

Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable

Describe the mitigative measures below and supply references to the appropriate appendix in the EID.

Mitigative Measure Description	*Reference(s)*
An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and wetlands and the Cape Fear River. A stormwater permit will also be obtained prior to construction. Additionally, effluent limitations and monitoring requirements set forth in the NPDES permit for the WWTP will be adhered to. It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.	Appendix O – New Hanover County, NC – Unified Development Ordinance – Article 8: Erosion and Sedimentation Control

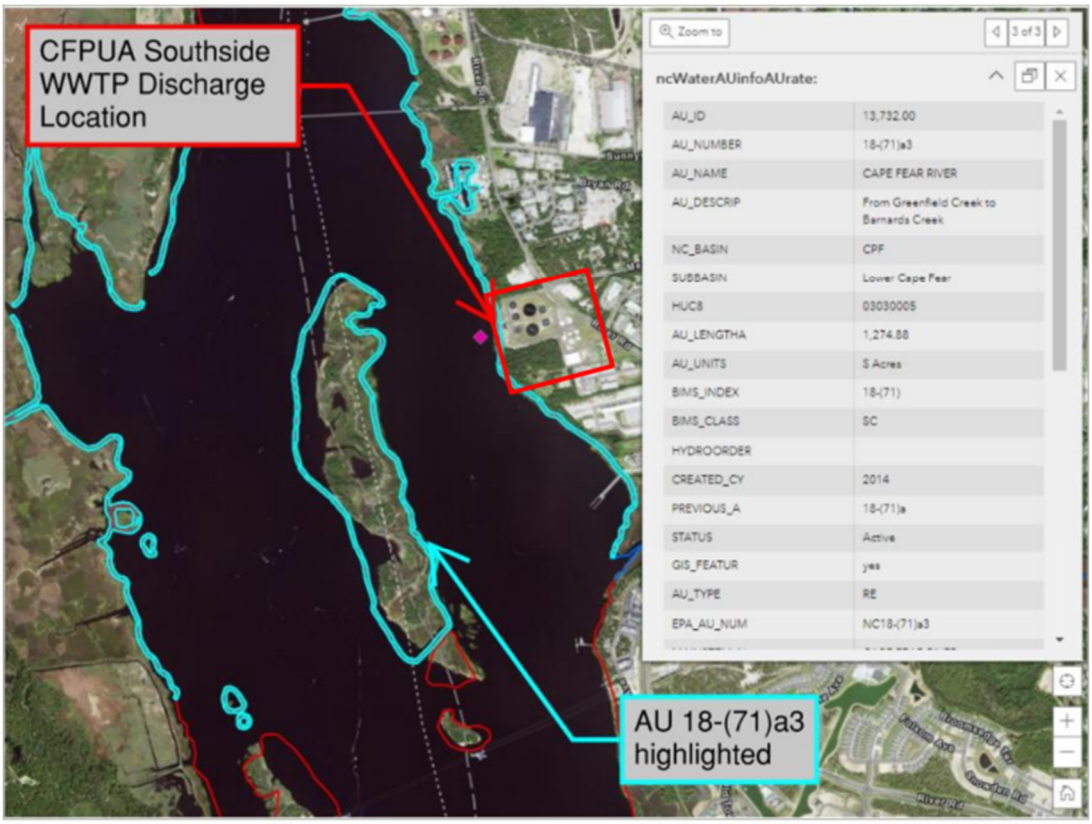


Figure 38. AU 18-(71)a3 Map

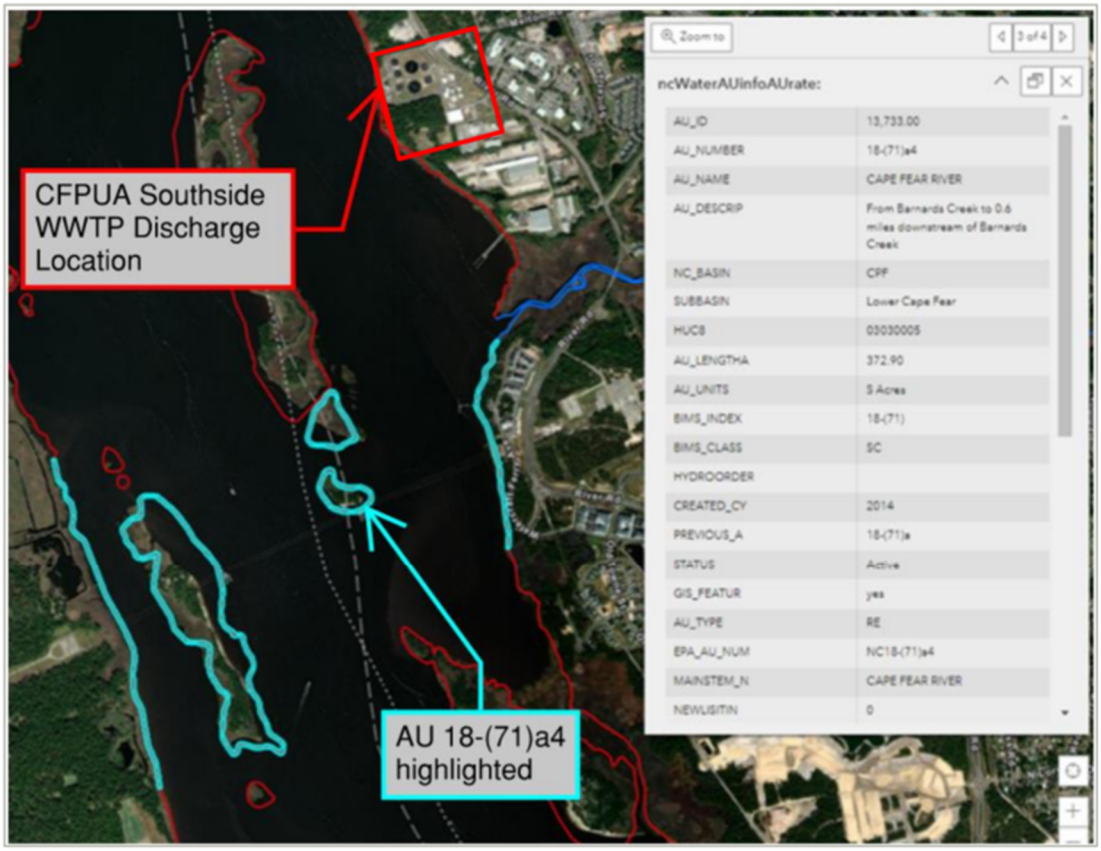


Figure 39. AU 18-(71)a4 Map

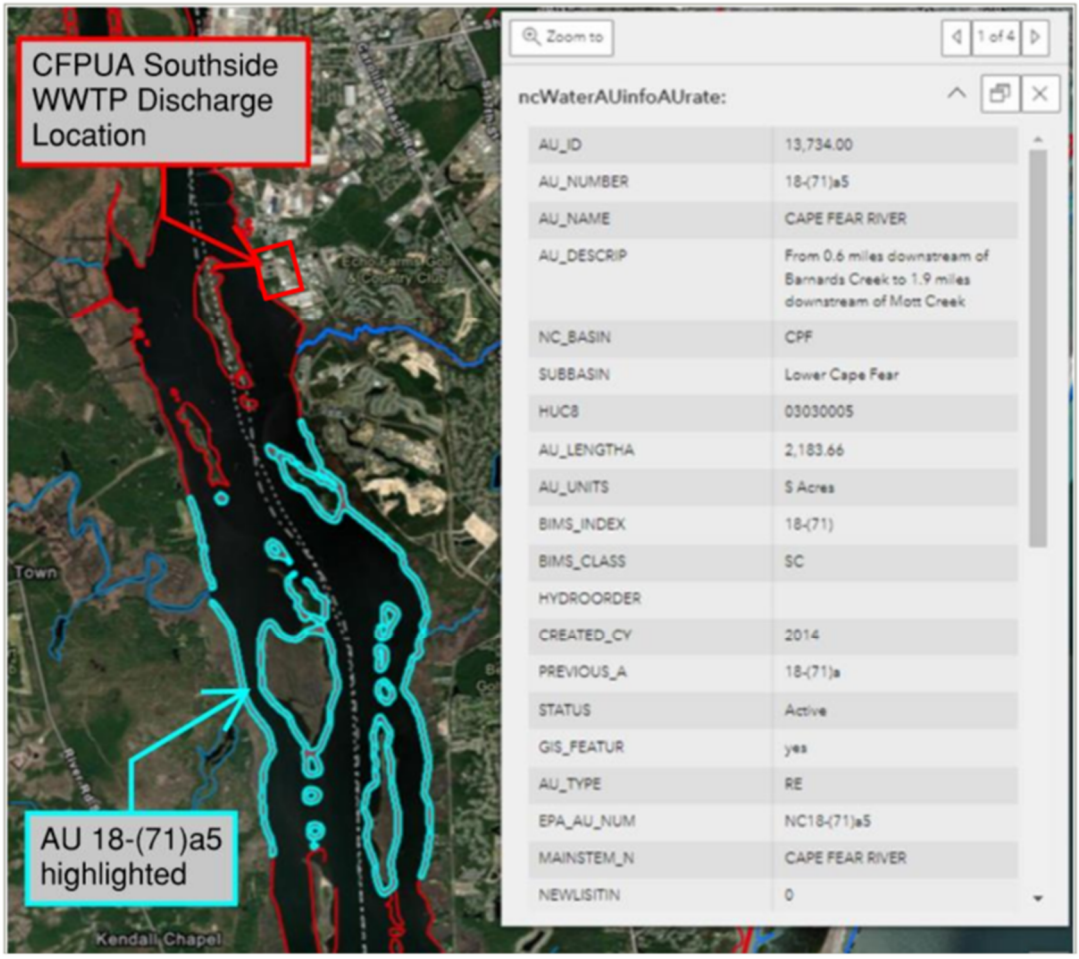


Figure 40. AU 18-(71)a5 Map

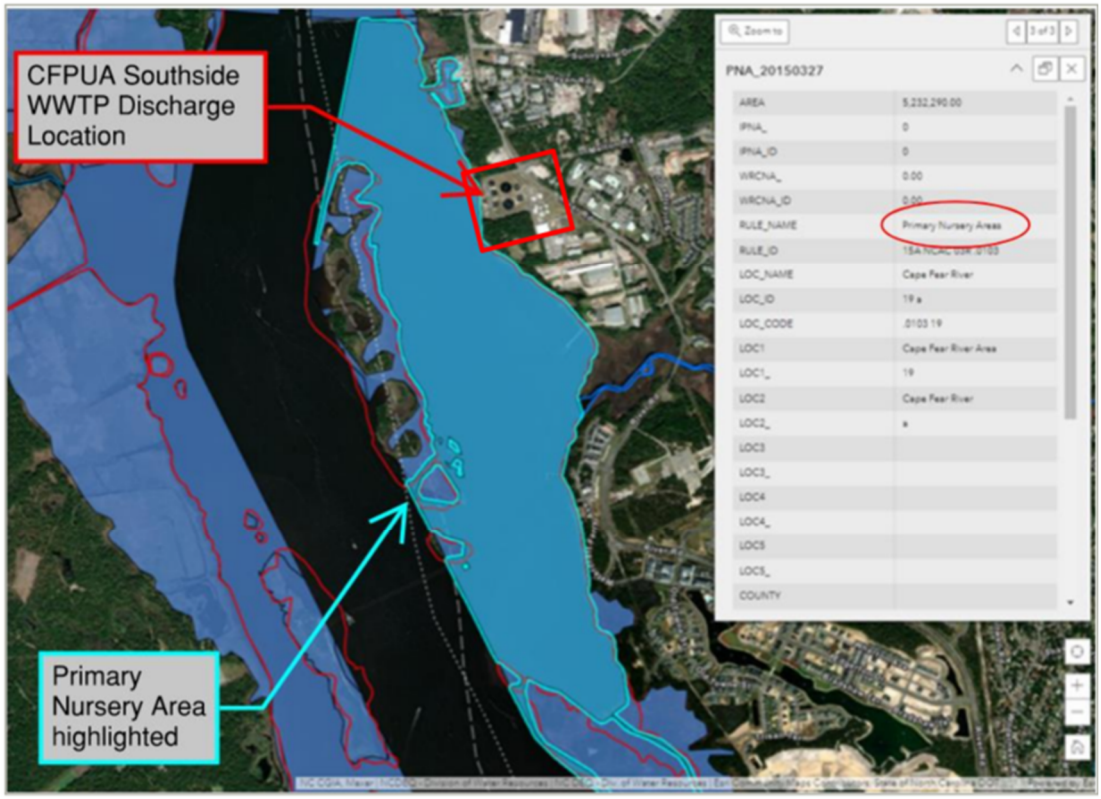


Figure 41. Primary Nursery Area Designation Map

Table 7.8. Wild and Scenic Rivers			
Complete this table in accordance with Section 4.8 of the guidance.			
Wild and Scenic Rivers Appendix Information Appendix Reference (if applicable):			N/A
Existing Conditions			
Is the project located within one mile of one of the designated Wild & Scene Rivers or a river in the Nationwide Rivers Inventory or its tributaries?			☐ Yes ☒ No
If Yes, check the applicable river(s) / stream(s).			
Chattooga River Horsepasture River Lumber River	☐ ☐ ☐	New River Wilson Creek	☐ ☐
If "Yes" was checked above, is the stream reach in the project area designated as Wild & Scenic?			
N/A			
Impacts			
Discuss any construction impacts related to these stream reaches.			
N/A			
Discuss any operational impacts related to these stream reaches.			
N/A			
Describe the SCI of the project.			
N/A			
Mitigative Measures			
Mitigative Measures for Construction Impacts		*Mitigative Measures for SCI*	
☐ Yes ☒ Not Applicable		☐ Yes ☒ Not Applicable	
Describe the mitigative measures below and supply references to the appropriate appendix in the EID.			
Mitigative Measure Description			*Reference(s)*
The wild and scenic rivers listed above are not near the project area; therefore, no mitigative measures for construction impacts and SCI are applicable.			N/A

Table 7.9. Coastal Resources	
Complete this table in accordance with Section 4.9 of the guidance.	
Coastal Resources Appendix Information and Appendix Reference (if applicable)	Appendix R
CAMA	
Is the project in a CAMA county listed in the guidance? (If no, skip the rest of the table.)	☒ Yes ☐ No
Does the project involve new construction, land conversion, major rehabilitation, and substantial improvement activities?	☒ Yes ☐ No
If "Yes" to both questions, discuss consistency review with Division of Coastal Management and include any relevant documentation in an appendix.	
Based on communication with the Division of Coastal Management, as shown in Appendix R, if the proposed work is taking place landward of coastal and 404 wetlands and is also farther landward than 75 ft from the HWL, then it would potentially be outside of CAMA jurisdiction. If work is taking place within 75 ft of the HWL, then a consistency review will be required. The proposed work will be located within the required 75 ft setback and therefore, a consistency review will be required.	
Coastal Barriers	
Is the project located within a CBRS community? If "Yes," attach a FIRM map indicating whether construction activity occurs in a CBRS and provide documentation of US Fish and Wildlife Service approval in an Appendix. Include the appropriate Appendix reference at the top of this table.	☐ Yes ☒ No

Table 7.10. Shellfish, Fish, and Their Habitats
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table in accordance with Section 4.10 of this guidance.

Shellfish, Fish, and Their Habitats Information Appendix Reference (if applicable):	Appendix S

Existing Conditions

Are T&E species present within the project site, the project area, or downstream from the project?

☒ Yes ☐ No

If Yes, list all aquatic T&E species located in the waterbodies within the project site, in the project area, and downstream of the project site. Show approximate location(s) on the Environmental Features Figure.

Aquatic T&E Species Figure Reference Number (if applicable):			Figure 42 & Figure 43
Common Name	*Scientific Name*	*Status*	*Approximate Location (e.g., 5 mi. NE of Project)*
Atlantic Sturgeon	*Acipenser oxyrinchur oxyrinchus*	Endangered	Within 1 mile of project
Shortnose Sturgeon	*Acipenser brevirostrum*	Endangered	Within 1 mile of project

Discuss shellfish and fish habitat. (Not just T&E species.)

The aquatic species present in the water bodies of the project area are characteristic of southeastern North Carolina. A full list of shellfish, fish, and their habitats in the project area can be found in the "Potential Occurrences" table from the North Carolina Natural Heritage Program. The Cape Fear River is recognized by Fish and Wildlife Servies as an Anadromous Fish Spawning Area. Waters within the project area are prohibited to shell fishing.

The project area is situated within a fishery nursery area (see Figure 42) and an anadromous fish spawning area (see Figure 43). The project area is situated adjacent to an area of the Cape Fear River permanently closed to shellfish harvesting.

Impacts

Discuss any impacts to threatened and endangered species.

No impacts to threatened and endangered species are anticipated as a result of this project.

Table 7.10. Shellfish, Fish, and Their Habitats
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Discuss construction impacts related to fish, shellfish, and their habitats.

The effluent discharge location will remain at the currently permitted side-stream discharge location to the Cape Fear River. Improvements will be necessary to expand the discharge capacity to accommodate the expanded facility. Direct impacts associated with the construction of the discharge force main improvements will be kept to a minimum and no permanent impacts to fish, shellfish, or their habitats are anticipated.

Past trends have shown a negative impact on fish, shellfish, and their habitats, in the project area, due to urbanization and agricultural runoff leading to increased pollution in the Cape Fear River. Expanding the wastewater treatment plant (WWTP) may lead to secondary and cumulative effects by facilitating further population growth and development. This, in turn, could deteriorate the water quality of the Cape Fear River, adversely affecting local shellfish and fish populations as well as their habitats. Future impacts to shellfish, fish, and their habitats may also be related to future development, urbanization, and agricultural runoff leading to increased pollution in the Cape Fear River. Regulations and conservation measures are anticipated to be sufficient to protect these populations.

This project area is located near the mouth of the Cape Fear River. Consequently, this area receives the positive and negative impacts of upstream activities. However, as previously stated, direct impact with the construction of this project will be kept to a minimum and no permanent impacts to fish, shellfish, or their habitats are anticipated. Conservation efforts are anticipated to balance the impacts of development and improved sustainable practices to protect fish and shellfish populations.

Discuss operational impacts related to fish, shellfish, and their habitats.

Operation of the project is not anticipated to impact fish, shellfish, and their habitats. The project will positively impact the water quality of the Cape Fear River, which will positively impact fish, shellfish, and their habitats.

Describe SCI of the project.

An expanded WWTP could support additional population growth and development, which could negatively affect the water quality of the Cape Fear River, which would negatively impact regional shellfish, fish, and their habitats.

Mitigative Measures

Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable

Describe the mitigative measures below and supply references to the appropriate appendix in the EID.

Table 7.10. Shellfish, Fish, and Their Habitats Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority	
Mitigative Measure Description	*Reference(s)*
An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and wetlands and the Cape Fear River. A stormwater permit will also be obtained prior to construction. Additionally, effluent limitations and monitoring requirements set forth in the NPDES permit will be adhered to. It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.	Appendix O – New Hanover County, NC – Unified Development Ordinance – Article 8: Erosion and Sedimentation Control

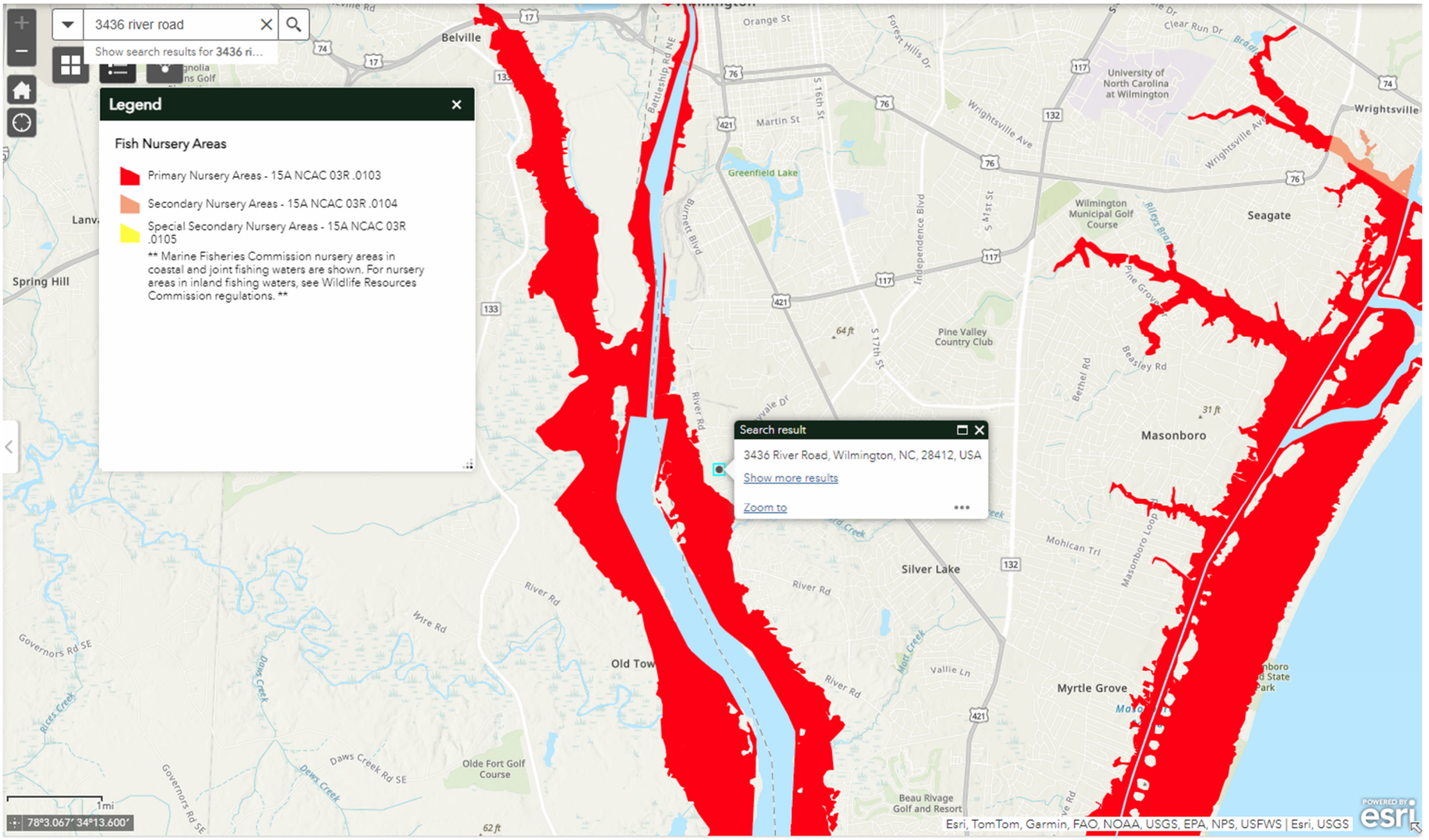


Figure 42. Fish Nursery Areas Map

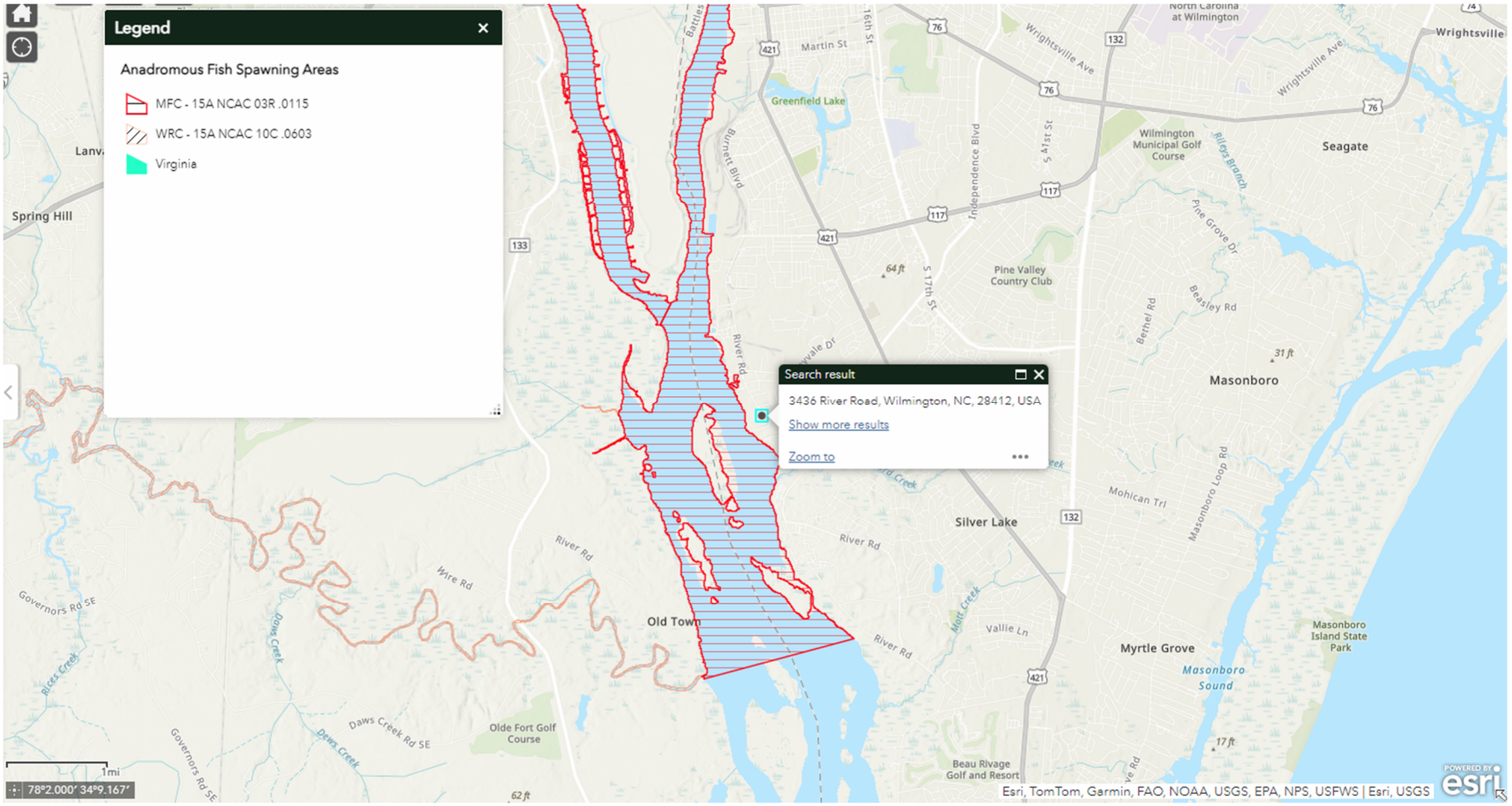


Figure 43. Anadromous Fish Spawning Areas Map

Table 7.11. Wildlife and Natural Vegetation
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table in accordance with Section 4.11 of the guidance.

Wildlife and Natural Vegetation Information Appendix Reference (if applicable)	Appendix T

Existing Conditions

Are T&E species present within the project site, or project area?

☒ Yes ☐ No

If Yes, list all terrestrial T&E species located in the project site or project area. Show approximate location(s) on the Environmental Features Figure.

Terrestrial T&E Species Figure Reference Number (if applicable):			Appendix T
Common Name	*Scientific Name*	*Status*	*Approximate Location (e.g., 5 mi. NE of Project)*
Carolina Gopher Frog	*Rana capito*	Endangered	Within 1 mile of project
American Alligator	*Alligator mississippiensis*	Threatened	Within 1 mile of project
Silverling	*Baccharis glomeruliflora*	Endangered	Within 1 mile of project

Discuss the wildlife and vegetation present in the project site and project area. (Not just T&E species.)

Wildlife and natural vegetation in the project area are characteristic of southeastern North Carolina. The habitat present in the project area is characteristic of tidal freshwater marshes. Non-endangered and nonthreatened species present in the project area include the oak toad, coppery emerald dragonfly, eastern big-eared bat, rainbow snake, glossy crayfish snake, diamondback terrapin, hidden-flowered witchgrass, and slender blue iris. A full list of wildlife and natural vegetation in the project area can be found in the "Potential Occurrences" table from the North Carolina Natural Heritage Program. The T&E species include Carolina Gopher Frog, American Alligator, and Silverling.

Although the T&E species listed above may be located within the project area, the threatened and endangered wildlife and vegetation listed are not expected to be present on the project site. Construction activities will be limited to CFPUA owned land and will not impact conservation lands or managed areas (MAREA). Clearing will be limited to the greatest extent possible.

Impacts

Discuss any impacts to threatened and endangered species.

Past trends have shown negative impacts to wildlife and natural vegetation within the project area due to land development, decreasing wildlife habitat and vegetation. This project area is located near the mouth of the Cape Fear River. Consequently, this area receives the positive and negative impacts of upstream activities. However, as previously stated, direct impact associated with the construction of this project will be kept to a minimum as well as permanent impacts to wildlife and natural vegetation due to clearing requirements.

The habitat area and potential presence of threatened and endangered wildlife and natural vegetation listed previously are not anticipated to be permanently disturbed by the proposed project, as they are not expected to be present on the site.

Discuss construction impacts related to wildlife and natural vegetation.

No impacts to wildlife and natural vegetation are anticipated due to construction.

Table 7.11. Wildlife and Natural Vegetation Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority	
Describe SCI of the project.	
An expanded WWTP could support additional population growth and development, which could affect the wildlife and natural vegetation of the region.	
Mitigative Measures	
Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable
Describe the mitigative measures below and supply references to the appropriate appendix in the EID.	
Mitigative Measure Description	*Reference(s)*
Construction activities will be limited to CFPUA owned land and will not impact conservation lands or managed areas. Clearing will be limited to the greatest extent possible. It is anticipated that future developers will coordinate with federal and state agencies to ensure appropriate laws and regulations are adhered to.	N/A

Table 7.12. Public Lands and Scenic, Recreational, and State Natural Areas Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority	
Complete this table in accordance with Section 4.12 of the guidance.	
Public Lands and Scenic, Recreational, and State Natural Area Figure Reference Number (if applicable):	Figure 44, Figure 45, and Figure 46
Public Lands and Scenic, Recreational, and State Natural Area Information Appendix Reference (if applicable):	Appendix T
Existing Conditions	
Are public lands and scenic, recreational, and state natural areas found adjacent to or in the project area?	
☒ Yes ☐ No (then no impact)	
If yes, list these areas and show on the Environmental Features Figure	

Name	*Type*	*Location (e.g., 5 mi. NE of Project)*
City of Wilmington Open Space	Local Government Ownership	Within 1 mile of project
NC Land and Water Fund Conservation Agreement	State Managed Area	Within 1 mile of project
NC Forest Legacy Easement	Managed Area	Within 1.75 miles of project
NC Coastal Land Trust Easement	Managed Area	Within 2 miles of project
Barnards Creek Natural Area	Natural Area	Within 1 mile of project
CPF/Lower Cape Fear River Aquatic Habitat	Natural Area	Within 1 mile of project
South Wilmington Sandhills	Natural Area	Within 2.5 miles of project
Mott Creek Natural Area	Natural Area	Within 3 miles of project
Pleasant Oaks/Goose Landing Plantations	Natural Area	Within 2.5 miles of project
Town Creek Marshes and Swamp	Natural Area	Within 3 miles of project
Clarendon Plantation Limesinks	Natural Area	Within 1.5 miles of project
Cameron Park	City of Wilmington Park	2.4 mi. N
Godwin Ball Field	City of Wilmington Park	1.8 mi. N
Greenfield Park	City of Wilmington Park	3.3 mi. N
Halyburton Park	City of Wilmington Park	2.4 mi. E
Hanover Heights Park	City of Wilmington Park	1.9 mi. NE
Legion Stadium	City of Wilmington Park	2.5 mi. N
Optimist Park	City of Wilmington Park	3.3 mi. N
Southgate Park	City of Wilmington Park	1.2 mi. E
Sunset & Adams Park	City of Wilmington Park	2.7 mi. N
Arrowhead Park	New Hanover County Park	2.8 mi. SE

Table 7.12. Public Lands and Scenic, Recreational, and State Natural Areas
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Impacts	
If Yes, discuss construction impacts related to public lands, and scenic, recreational, and state natural areas.	
Sedimentation and runoff from construction activities on the WWTP site could affect the CPF/Lower Cape Fear River Aquatic Habitat (which is adjacent to the project site); however, it is anticipated that erosion and sedimentation control measures will be sufficient to mitigate the potential impacts. Construction impacts related to other public lands, and scenic, recreational, and state natural areas are not expected, as they are outside of the project site.	
If Yes, discuss operational impacts related to public lands, and scenic, recreational, and state natural areas.	
The proposed project will improve the quality of the CPF/Lower Cape Fear River Aquatic Habitat, as the DO load will be reduced, as detailed in Table 7.7. Operational impacts related to other public lands, and scenic, recreational, and state natural areas are not expected, as they are outside of the project site.	
Describe SCI of the project.	
An expanded WWTP could support additional population growth and development, which could affect regional public lands, and scenic, recreational, and state natural areas.	
Mitigative Measures	
Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable
Describe the mitigative measures below and supply references to the appropriate appendix in the EID.	
Mitigative Measure Description	*Reference(s)*
An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and wetlands and the Cape Fear River. A stormwater permit will also be obtained prior to construction. Additionally, effluent limitations and monitoring requirements set forth in the NPDES permit for the WWTP will be adhered to. It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.	Appendix O – New Hanover County, NC – Unified Development Ordinance – Article 8: Erosion and Sedimentation Control

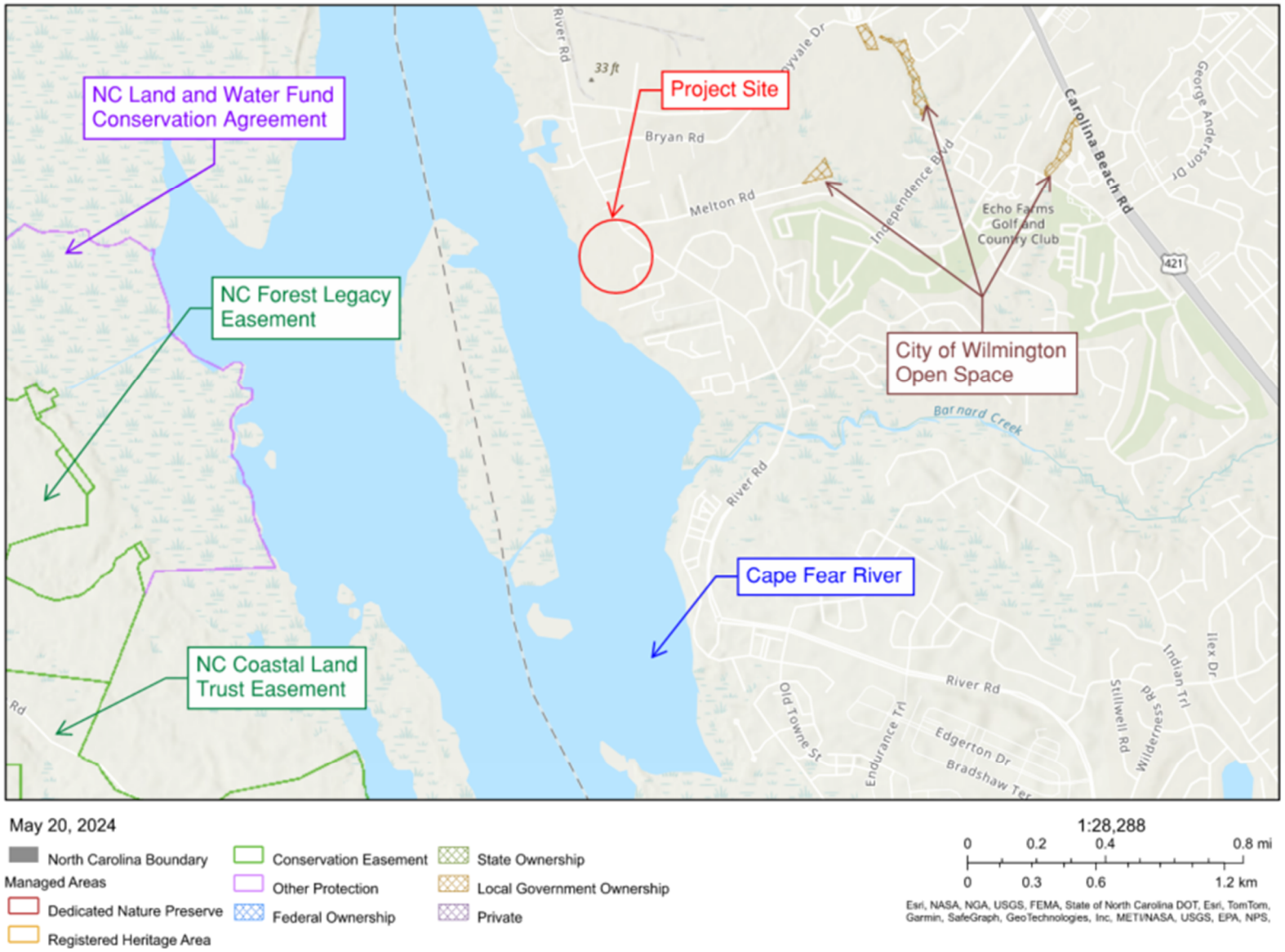


Figure 44. NC Natural Heritage Program Managed Areas

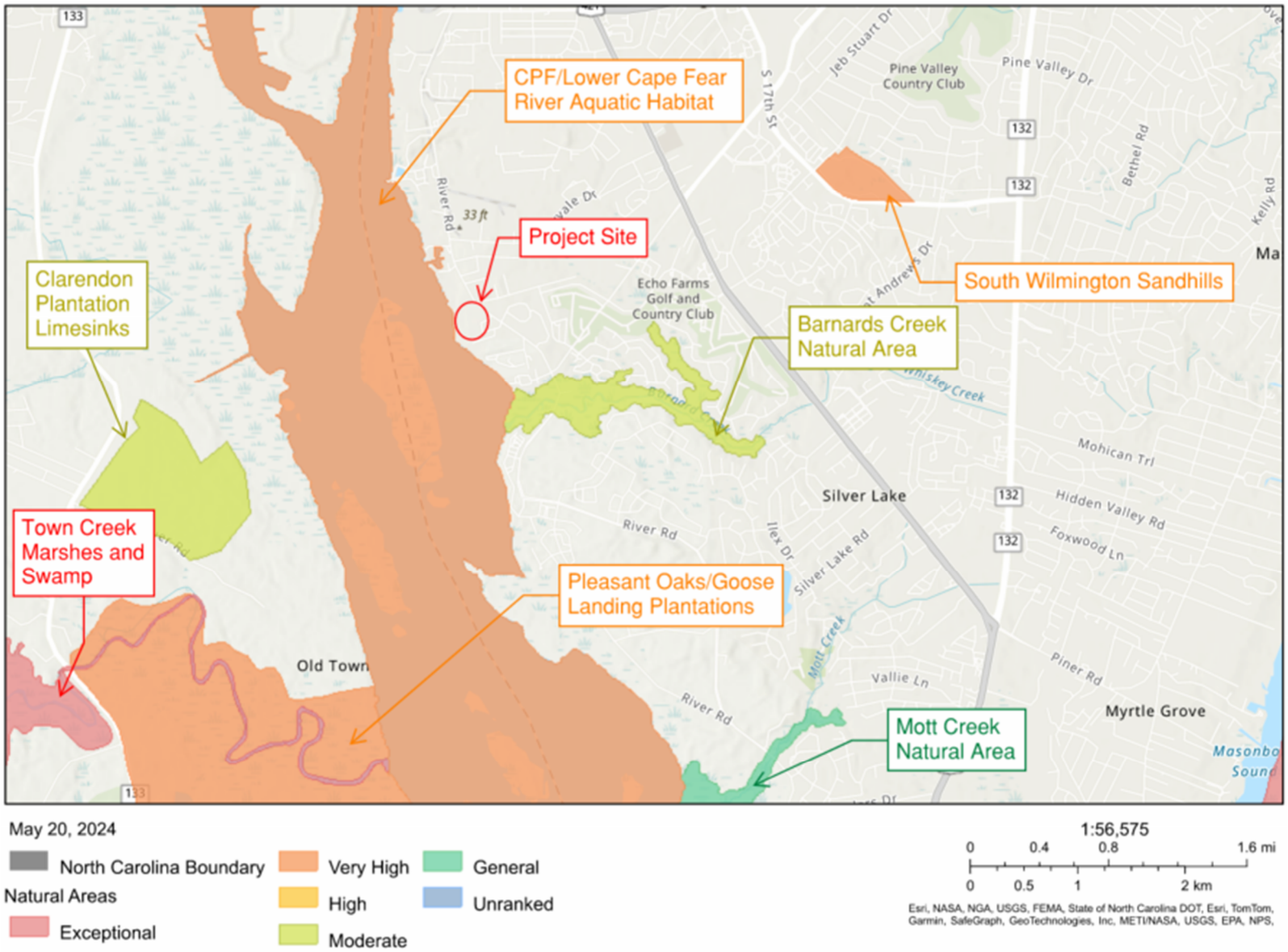


Figure 45. NC Natural Areas



Figure 46. Public Parks Map

Table 7.13. Areas of Archaeological or Historical Value
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table in accordance with Section 4.13 of this guidance.

Archaeological or Historical Area Figure Reference Number (if applicable):	Figure 47
Archaeological or Historical Area Information Appendix Reference (if applicable):	Appendix U and Appendix V

Existing Conditions

Are areas of archaeological or historical value in the project site, project vicinity, or project area?

☒ Yes ☐ No (No Impact)

If yes, list these and show on the Environmental Features Figure

Name	*Type*	*Location (e.g., 5 mi. NE of Project)*
Site 31NH802	Archeological Site	On project site
Sunset Park Historic District	National Register of Historic Places	2.5 mi. N

Impacts

If Yes, discuss construction impacts related to areas or archaeological or historical value?

The North Carolina Department of Natural and Cultural Resources takes no objection to the proposed project, as stated in the memorandum included in Appendix U. This memorandum states that a portion of the project site contains prehistoric archaeological site 31NH802; however, this site has since been successfully mitigated under project number ER 08-2099. In the unlikely event that human remains are discovered during construction, the contractor must immediately cease and contact the county medical examiner. Further, a Memorandum of Agreement (MOA) (Appendix V) was executed in 2009. This document provides a summary of the mitigation measures that are required to construct the WWTP expansion on the archaeological site.

If Yes, discuss operational impacts related to areas of archaeological or historical value.

No operational impacts are anticipated.

Describe SCI of the project.

An expanded WWTP could support additional population growth and development, which could alter known and/or unknown archaeological or historical areas.

Mitigative Measures

Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable

Table 7.13. Areas of Archaeological or Historical Value Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority	
Describe the mitigative measures below and supply references to the appropriate appendix in the EID.	
Mitigative Measure Description	*Reference(s)*
Environmental Services, Inc. implemented and compiled a data recovery plan of site 31NH802, as required by the MOA in Appendix V. This MOA also requires the contractor to arrange for the conservation treatment and curation of all artifacts, records, and materials recovered or generated during the project. Should unmarked human burials or human skeletal remains be encountered during investigation, notification of the proper authorities shall proceed according to the provisions of G.S. 70, Article 3, "The Unmarked Human Burial and Human Skeletal Remains Protection Act." It is anticipated that potential future developers will do their due diligence to ensure future projects do not adversely affect areas of known archaeological or historical value. Should future contractors uncover artifacts of archaeological or historical value, construction shall immediately be halted, and the appropriate authorities shall be contacted.	Appendix V

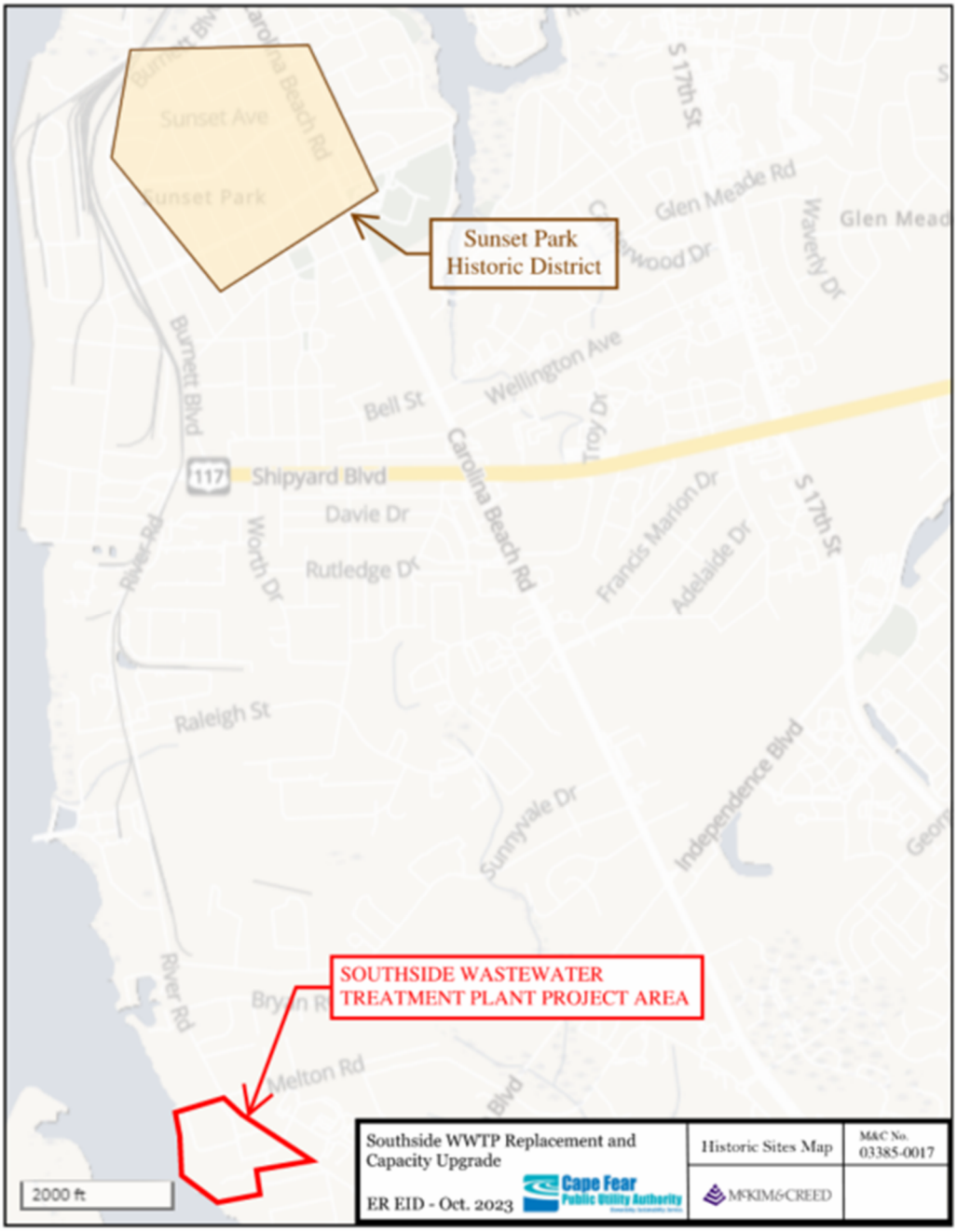


Figure 47. Historic Sites Map

Table 7.14. Air Quality
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete the table in accordance with Section 4.14 of the guidance.

Air Quality Information Appendix Reference (if applicable):	N/A

Existing Conditions

Discuss the general air quality and identify current sources of emissions from the project and surrounding area. Note whether odors have been a problem.

The air quality in the project area is in conformance with standards. There are existing odor control measures taken at the existing WWTP site to mitigate odor caused by wastewater. There are no emissions from the project site and no known odor problems. There are some minor impacts to air quality due to vehicular traffic including tractor-trailers, trash trucks, and trains. The project area is near the Port of Wilmington and that likely impacts the general air quality in the project area.

Impacts

Discuss construction impacts related to air quality.

No permanent impacts to air quality are anticipated. The project may cause temporary, direct impacts, from emissions from construction equipment and as dust/particulates are generated during construction.

Will open burning occur?	*If Yes, describe what will be burned.*
☐ Yes ☒ No	N/A

Discuss operational impacts related to air quality.

Operational impacts are not anticipated to affect air quality. The plant is already in operation and the improvements should not cause permanent impacts to air quality. Anaerobic digesters are currently in place for odor control. The plant upgrades will maintain or improve the existing air quality conditions by adding new odor control facilities.

Describe SCI of the project.

An expanded WWTP could support additional population growth and development, which could negatively affect the region's air quality.

Mitigative Measures

Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable

Describe the mitigative measures below and supply references to the appropriate appendix in the EID.

Mitigative Measure Description	*Reference(s)*
Dust will be kept to a minimum and construction equipment will be required to adhere to NC standards. Dust control procedures such as spraying and sweeping will be implemented as needed as the project progresses. New odor control equipment will be installed to improve the air quality at the WWTP. The contractor shall ensure construction vehicles/equipment are equipped with emission control devices. It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.	Appendix W

Table 7.15. Noise Levels Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority	
Complete this table in accordance with Section 4.15 of the guidance.	
Noise Level Information Appendix Reference (if applicable):	Appendix X
Existing Conditions	
Discuss the current noise levels for the project site and project area.	
There are no current noise problems at the project site or project area. It should be noted that due to the proximity of the Port of Wilmington and many industrial, commercial, and municipal buildings, noise levels due to vehicular traffic and the previously mentioned businesses are elevated slightly above a standard residential neighborhood within the area.	
Does the LGU have noise ordinances in place?	☒ Yes ☐ No
If yes, describe.	City of Wilmington has a noise ordinance that is provided in Appendix X and prohibits any unreasonably loud and disturbing noise in the City of Wilmington.
Impacts	
Discuss construction impacts related to noise levels. If noise levels will increase, discuss when they will be heard and at what distance.	
Noise levels will temporarily increase during construction within a close proximity to the project site. Construction will take place during regular business hours (8 AM to 5 PM Monday through Friday) unless previously approved.	
Discuss operational impacts related to noise levels.	
Operational impacts are anticipated to stay the same as existing conditions, as the plant is already operational.	
Describe SCI of the project.	
No secondary and cumulative impacts are anticipated for this project.	
Mitigative Measures	
Mitigative Measures for Construction Impacts?	*Mitigative Measures for SCI?*
☒ Yes ☐ Not Applicable	☒ Yes ☐ Not Applicable
Describe the mitigative measures below and supply references to the appropriate appendix in the EID.	
Mitigative Measure Description	*Reference(s)*
Mitigation of construction impact to noise levels will include restricting construction to work hours during normal weekday operations. Also, the City of Wilmington noise ordinance will help to mitigate any other impacts to noise levels. It is anticipated that existing local ordinances will mitigate potential impacts caused by population growth and development.	Appendix X

Table 7.16. Introduction of Toxic Substances Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority	
Introduction to Toxic Substances Appendix Reference (if applicable):	N/A
Impacts	
Discuss any toxic substances that may be introduced during project construction and operation in accordance with Section 4.16 of the guidance.	
There is a minimal possibility that toxic substances from oil or other substances from operation of construction equipment could be introduced to the site from a spill. Toxic substances are not anticipated to be introduced during construction.	
Mitigative Measures	
Mitigative Measures for Construction Impacts?	
☒ Yes ☐ Not Applicable	
Describe the mitigative measures below and supply references to the appropriate appendix in the EID.	
Mitigative Measure Description	*Reference(s)*
Contractor to be informed that toxic substances or changing/dumping of oil onsite is not allowed.	N/A

Table 7.17. Environmental Justice Analysis
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table in accordance with Section 4.17 of the guidance.

Was the U.S. Environmental Protection Agency's Environmental EJ Screen Tool used? If No, then complete the Existing Conditions cells below.	☒ Yes ☐ No
Environmental Justice Figure Reference Number(s):	N/A
Environmental Justice Information Appendix Reference (if applicable):	Appendix Y

Existing Conditions

Provide the following information and key the Block Groups to the map in the EID. Include figures.

County	Census Tract	Census Block Group	Total Population	Minority Population	Percent Minority Population	Significant Minority Population?	Low-Income Population	Percent Low-Income Population	Significant Low Income Population?
New Hanover	0121.11	371290121011	10,139	3,346	33%	No	4,157	41%	No

Impacts

Are there any potentially significant environmental justice populations in the project area?	☐ Yes	☒ No

If the answer is yes, then below, list the impacts to the minority and/or low-income populations below and whether the impacts are potentially significant. If potentially significant, contact the Environmental Assessment Coordinator.

Impact	*Potentially Significant?*
N/A	☐ Yes ☐ No
	☐ Yes ☐ No
	☐ Yes ☐ No
	☐ Yes ☐ No
	☐ Yes ☐ No
	☐ Yes ☐ No
	☐ Yes ☐ No

Table 7.18. Mitigative Measures
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table for all resource categories in accordance with Section 4.18 of the guidance. If there was no impact in a particular resource category, then state, "No Impact."

Resource Category	Potential Direct Impact	Mitigative Measure(s) for Direct Impact	Potential SCI	Mitigative Measures for SCI
Topography & Floodplains	The project will permanently impact the topography in the immediate areas of the proposed structures. Any additional impacts to topography in the project area will be temporary to facilitate construction. Such temporary impacts include excavation for installation of subsurface utilities. These areas of temporary topography disturbances will be returned to existing, pre-construction conditions utilizing the mitigative measures described below. The proposed project includes removing the existing UV disinfection channels, which are installed within the 100-year floodplain, and installing new UV disinfection channels outside of the 100-year floodplain. This will permanently benefit the 100-year floodplain, as these units will be removed outside of the floodplain. The proposed project also includes replacing the existing effluent discharge piping, which is within the 100-year floodplain and 100-year floodway, with larger piping. This will permanently impact the 100-year floodplain and 100-year floodway; however, there are no practicable alternatives to situate the effluent discharge piping outside of these boundaries. Direct impacts associated with the construction of the new effluent piping will be minimized using the mitigative measures described below. It should be noted that the effluent discharge point will not change. The navigable channel within the Cape Fear River will not be impacted by the new discharge piping.	An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and the Cape Fear River to mitigate temporary impacts. A stormwater permit will also be obtained prior to construction. Stormwater infrastructure will be installed to mitigate permanent impacts to the topography. Most of the expansion site will likely not be re-graded to its original contours, as permanent impacts to the topography will be required to install some of the equipment of the proposed project. Regrading will be conducted in areas indicated in a future approved grading plan. The measures listed above will mitigate impacts to the topography and floodplain. Zoning laws and regulations enforced by the governing body will mitigate potential impacts caused by population growth and development.	An expanded WWTP could support additional population growth and development, which could alter the region's topography.	Zoning laws and regulations enforced by the governing body will mitigate potential impacts caused by population growth and development.
Soils	Direct impacts from construction are anticipated to be minimal. Most of the project components that are new or need to be replaced are above grade. Most of the anticipated soil disturbances will occur during construction of the pump stations and structural foundations for WWTP components. Where applicable, the appropriate stormwater infrastructure	An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Mineral and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls will be	An expanded WWTP could support additional population growth and	Secondary and cumulative impacts shall be mitigated by adhering to project specific state approved erosion and

Table 7.18. Mitigative Measures
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table for all resource categories in accordance with Section 4.18 of the guidance. If there was no impact in a particular resource category, then state, "No Impact."

Resource Category	Potential Direct Impact	Mitigative Measure(s) for Direct Impact	Potential SCI	Mitigative Measures for SCI
	improvements will be provided, as required by the local and State regulations to provide the appropriate grading and drainage on the project site. If unsuitable soil is encountered during construction, the Contractor will be responsible for moving and disposing of that soil in accordance with all applicable regulations. The Contractor will also be required to use fill to replace the unsuitable soils for construction.	installed and maintained between the construction site and any the Cape Fear River. If encountered during construction, contaminated soil will be removed from the project site and disposed of by the Contractor. If the shooting range yard is to be used for contractor lay-down area during construction, it is recommended that the ground surface and berm be isolated from each other to avoid soil contact with contractor personnel, per Appendix K. As required, containment action plans will be developed by a subconsultant with extensive experience with contaminated sites in this region.	development, which could alter the region's soils.	sedimentation control plans.
Prime & Unique Farmland	No impact.	N/A	An expanded WWTP could support additional population growth and development, which could affect prime and unique farmland in the region. Future developers shall coordinate with the NCRS to determine if	City of Wilmington zoning laws and regulations will mitigate potential impacts caused by regional population growth and development. Future developers shall coordinate with the NCRS to determine if proposed projects will adversely affect prime and unique farmlands.

Table 7.18. Mitigative Measures Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority				
Complete this table for all resource categories in accordance with Section 4.18 of the guidance. If there was no impact in a particular resource category, then state, "No Impact."				
Resource Category	**Potential Direct Impact**	**Mitigative Measure(s) for Direct Impact**	**Potential SCI**	**Mitigative Measures for SCI**
			proposed projects will adversely affect prime and unique farmlands.	
Land Use	The land use of the project site will remain the same. No direct impacts are anticipated.	N/A	An expanded WWTP could support additional population growth and development, which could alter the land use of the region.	City of Wilmington zoning laws and regulations will mitigate potential impacts caused by regional population growth and development.
Forest Resources	Approximately 7 acres of the wooded land will be cleared.	All requirements set forth in the latest version of the Code of Ordinances of the City of Wilmington will be adhered to in order to mitigate any negative impacts to regional forest resources caused by the proposed project. An approved tree removal permit will be required prior to commencement of construction.	An expanded WWTP could support additional population growth and development, which could alter forest resources of the region.	All requirements set forth in the latest version of the Code of Ordinances of the City of Wilmington will be adhered to in order to mitigate any negative impacts to regional forest resources caused by the proposed project. An approved tree removal permit will be required prior to commencement of construction.

Table 7.18. Mitigative Measures Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority				
Complete this table for all resource categories in accordance with Section 4.18 of the guidance. If there was no impact in a particular resource category, then state, "No Impact."				
Resource Category	**Potential Direct Impact**	**Mitigative Measure(s) for Direct Impact**	**Potential SCI**	**Mitigative Measures for SCI**
Wetlands and Streams	Sedimentation and runoff from construction activities on the WWTP site could affect water quality in the surrounding wetlands and river; however, local floodplain ordinance and erosion and sedimentation control measures will be sufficient to mitigate the potential impacts. The effluent discharge location will remain at the currently permitted side-stream discharge location to the Cape Fear River. Improvements will be necessary to expand the discharge capacity to accommodate the expanded facility. Direct impacts associated with the construction of the discharge force main improvements will be kept to a minimum and no permanent impacts are anticipated.	An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and wetlands and the Cape Fear River. A stormwater permit will also be obtained prior to construction. Additionally, a USACE Section 404 and CAMA permit will be applied for upon substantial completion of construction drawings. It will be noted on final plans that all conditions of these permits will be adhered to during construction.	Sedimentation and runoff from construction activities associated with increased development within the WWTP service area resulting from capacity expansion of the treatment plant could affect the water quality of surrounding wetlands and streams. However, it is anticipated that local floodplain ordinance and erosion and sedimentation control measures will be sufficient to mitigate the potential secondary and	It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.

Table 7.18. Mitigative Measures
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table for all resource categories in accordance with Section 4.18 of the guidance. If there was no impact in a particular resource category, then state, "No Impact."

Resource Category	Potential Direct Impact	Mitigative Measure(s) for Direct Impact	Potential SCI	Mitigative Measures for SCI
			cumulative impacts.	
Water Resources	Sedimentation and runoff from construction activities on the WWTP site could affect water quality in the surrounding wetlands and river; however, it is anticipated that local floodplain ordinances and erosion and sedimentation control measures will be sufficient to mitigate the potential impacts. No impacts to groundwater quality are anticipated because of the proposed project. The effluent water quality limitations and monitoring requirements set forth in Appendix D will be adhered to, as required by the State. The proposed project will improve the water quality of the Cape Fear River. Modifying the treatment units of the SSWWTP from trickling filters to aeration basins is estimated to result in a load reduction of 358 lbs/day of oxygen consuming load. This oxygen consuming load reduction will result in a direct improvement to the DO in the impaired PNA designated receiving Cape Fear River. Additionally, modifying the treatment process, as detailed above, is estimated to result in a load reduction of at least 2,913 lbs/day of ammonia. This ammonia load reduction will also benefit the impaired receiving PNA designated Cape Fear River since ammonia exerts an oxygen demand through the nitrification process.	An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and wetlands and the Cape Fear River. A stormwater permit will also be obtained prior to construction. Additionally, effluent limitations and monitoring requirements set forth in the NPDES permit for the WWTP will be adhered to.	Sedimentation and runoff from construction activities associated with increased development within the WWTP service area resulting from capacity expansion of the treatment plant could affect the water quality of surrounding surface water. However, it is anticipated that local floodplain ordinance and erosion and sedimentation control measures will be sufficient to mitigate the potential	It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.

Table 7.18. Mitigative Measures Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority				
Complete this table for all resource categories in accordance with Section 4.18 of the guidance. If there was no impact in a particular resource category, then state, "No Impact."				
Resource Category	**Potential Direct Impact**	**Mitigative Measure(s) for Direct Impact**	**Potential SCI**	**Mitigative Measures for SCI**
			secondary and cumulative impacts.	
Shellfish, Fish, and their Habitats	No impacts to threatened and endangered species are anticipated as a result of this project. The effluent discharge location will remain at the currently permitted side-stream discharge location to the Cape Fear River. Improvements will be necessary to expand the discharge capacity to accommodate the expanded facility. Direct impacts associated with the construction of the discharge force main improvements will be kept to a minimum and no permanent impacts to fish, shellfish, or their habitats are anticipated. Past trends have shown a negative impact on fish, shellfish, and their habitats, in the project area, due to urbanization and agricultural runoff leading to increased pollution in the Cape Fear River. Expanding the wastewater treatment plant (WWTP) may lead to secondary and cumulative effects by facilitating further population growth and development. This, in turn, could deteriorate the water quality of the Cape Fear River, adversely affecting local shellfish and fish populations as well as their habitats. Future impacts to shellfish, fish, and their habitats may also be related to future development, urbanization, and agricultural runoff leading to increased pollution in the Cape Fear River. Regulations and conservation measures are anticipated to be sufficient to protect these populations. This project area is located near the mouth of the Cape Fear River. Consequently, this area receives the positive and negative impacts of upstream activities. However, as previously stated, direct impact with the construction of this	An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and wetlands and the Cape Fear River. A stormwater permit will also be obtained prior to construction. Additionally, effluent limitations and monitoring requirements set forth in the NPDES permit will be adhered to.	An expanded WWTP could support additional population growth and development, which could negatively affect the water quality of the Cape Fear River, which would negatively impact regional shellfish, fish, and their habitats.	It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.

Table 7.18. Mitigative Measures Southside WWTP Replacement & Capacity Upgrade Cape Fear Public Utility Authority				
Complete this table for all resource categories in accordance with Section 4.18 of the guidance. If there was no impact in a particular resource category, then state, "No Impact."				
Resource Category	**Potential Direct Impact**	**Mitigative Measure(s) for Direct Impact**	**Potential SCI**	**Mitigative Measures for SCI**
	project will be kept to a minimum and no permanent impacts to fish, shellfish, or their habitats are anticipated. Conservation efforts are anticipated to balance the impacts of development and improved sustainable practices to protect fish and shellfish populations. Operation of the project is not anticipated to impact fish, shellfish, and their habitats. The project will positively impact the water quality of the Cape Fear River, which will positively impact fish, shellfish, and their habitats.			
Wildlife and Natural Vegetation	Past trends have shown negative impacts to wildlife and natural vegetation within the project area due to land development, decreasing wildlife habitat and vegetation. This project area is located near the mouth of the Cape Fear River. Consequently, this area receives the positive and negative impacts of upstream activities. However, as previously stated, direct impact associated with the construction of this project will be kept to a minimum as well as permanent impacts to wildlife and natural vegetation due to clearing requirements. The habitat area and potential presence of threatened and endangered wildlife and natural vegetation listed previously are not anticipated to be permanently disturbed by the proposed project, as they are not expected to be present on the site.	Construction activities will be limited to CFPUA owned land and will not impact conservation lands or managed areas. Clearing will be limited to the greatest extent possible.	An expanded WWTP could support additional population growth and development, which could affect the wildlife and natural vegetation of the region.	It is anticipated that future developers will coordinate with federal and state agencies to ensure appropriate laws and regulations are adhered to.
Public Land and Scenic, Recreational, and State Natural Areas	Sedimentation and runoff from construction activities on the WWTP site could affect the CPF/Lower Cape Fear River Aquatic Habitat (which is adjacent to the project site); however, it is anticipated that erosion and sedimentation control measures will be sufficient to mitigate the potential impacts. Construction impacts related to other public lands, and scenic, recreational, and state natural areas are not expected, as they are outside of the project site.	An erosion and sedimentation control plan will be submitted to and approved by the North Carolina Division of Energy, Minerals and Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls (silt fence, check dams, traps, etc.) will be installed and maintained between the construction site and wetlands and the Cape Fear River. A stormwater	An expanded WWTP could support additional population growth and development, which could	It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.

Table 7.18. Mitigative Measures
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table for all resource categories in accordance with Section 4.18 of the guidance. If there was no impact in a particular resource category, then state, "No Impact."

Resource Category	Potential Direct Impact	Mitigative Measure(s) for Direct Impact	Potential SCI	Mitigative Measures for SCI
	The proposed project will improve the quality of the CPF/Lower Cape Fear River Aquatic Habitat, as the DO load will be reduced, as detailed in Table 7.7. Operational impacts related to other public lands, and scenic, recreational, and state natural areas are not expected, as they are outside of the project site.	permit will also be obtained prior to construction. Additionally, effluent limitations and monitoring requirements set forth in the NPDES permit for the WWTP will be adhered to.	affect regional public lands, and scenic, recreational, and state natural areas.	
Areas of Archaeological or Historical Value	The North Carolina Department of Natural and Cultural Resources takes no objection to the proposed project, as stated in the memorandum included in Appendix V. This memorandum states that a portion of the project site contains prehistoric archaeological site 31NH802; however, this site has since been successfully mitigated under project number ER 08-2099. In the unlikely event that human remains are discovered during construction, the contractor must immediately cease and contact the county medical examiner. Further, a Memorandum of Agreement (MOA) (Appendix V) was executed in 2009. This document provides a summary of the mitigation measures that are required to construct the WWTP expansion on the archaeological site. No operational impacts are anticipated.	Environmental Services, Inc. implemented and compiled a data recovery plan of site 31NH802, as required by the MOA in Appendix V. This MOA also requires the contractor to arrange for the conservation treatment and curation of all artifacts, records, and materials recovered or generated during the project. Should unmarked human burials or human skeletal remains be encountered during investigation, notification of the proper authorities shall proceed according to the provisions of G.S. 70, Article 3, "The Unmarked Human Burial and Human Skeletal Remains Protection Act."	An expanded WWTP could support additional population growth and development, which could alter known and/or unknown archaeological or historical areas.	It is anticipated that potential future developers will do their due diligence to ensure future projects do not adversely affect areas of known archaeological or historical value. Should future contractors uncover artifacts of archaeological or historical value, construction shall immediately be halted, and the appropriate authorities shall be contacted.
Air Quality	No permanent impacts to air quality are anticipated. The project may cause temporary, direct impacts, from emissions from construction equipment and as dust/particulates are generated during construction. Operational impacts are not anticipated to affect air quality. The plant is already in operation and the improvements should not cause permanent impacts to air quality. Anaerobic digesters are currently in place for odor control. The plant	Dust will be kept to a minimum and construction equipment will be required to adhere to NC standards. Dust control procedures such as spraying and sweeping will be implemented as needed as the project progresses. New odor control equipment will be installed to improve the air quality at the WWTP. The contractor shall equip	An expanded WWTP could support additional population growth and development, which could negatively	It is anticipated that existing permitting requirements and local ordinances will mitigate potential impacts caused by population growth and development.

Table 7.18. Mitigative Measures
Southside WWTP Replacement & Capacity Upgrade
Cape Fear Public Utility Authority

Complete this table for all resource categories in accordance with Section 4.18 of the guidance. If there was no impact in a particular resource category, then state, "No Impact."

Resource Category	Potential Direct Impact	Mitigative Measure(s) for Direct Impact	Potential SCI	Mitigative Measures for SCI
	upgrades will maintain or improve the existing air quality conditions by adding new odor control facilities.	construction vehicles with emission control devices.	affect the region's air quality.	
Noise Levels	Noise levels will temporarily increase during construction within a close proximity to the project site. Construction will take place during regular business hours (8 AM to 5 PM Monday through Friday) unless previously approved. Operational impacts are anticipated to stay the same as existing conditions, as the plant is already operational.	Mitigation of construction impact to noise levels will include restricting construction to work hours during normal weekday operations. Also, the City of Wilmington noise ordinance will help to mitigate any other impacts to noise levels.	No secondary and cumulative impacts are anticipated for this project.	It is anticipated that existing local ordinances will mitigate potential impacts caused by population growth and development.
Toxic Substances	There is a minimal possibility that toxic substances from oil or other substances from operation of construction equipment could be introduced to the site from a spill. Toxic substances are not anticipated to be introduced during construction.	Contractor to be informed that toxic substances or changing/dumping of oil onsite is not allowed.	No impact.	N/A
Environmental Justice	No impact.	N/A	No impact.	N/A

Section 8.0 Financials

A portion of the proposed project will be funded through the Clean Water State Revolving Fund (SRF) loan of $70,000,000 repayable at 1.76% interest with a 20-year payback period. Appendix Z includes a letter of intent to fund $35,000,000 worth of this loan; however, it should be noted that the other $35,000,000 loan will also be provided by the CWSRF. This additional loan was approved by the SWIA although the LOIF has not been issued yet.

$48,407,514 of the project cost will be funded through capital reserves. The remainder of the project cost will be funded by revenue bonds at an estimated interest rate of 4.5% with a 25-year repayment period. Please note that the revenue bonds have not been borrowed at this time and the interest rate is subject to change.

Table 8.1. Applicant's/LGUs Financial Condition
Southside Wastewater Treatment Plant
Replacement & Capacity Upgrade Project

Utility Bill as Percent of Median Household Income

Use the pulldown menu to select the type of rate structure used for water and sewer. If using a rate structure other than uniform, then there is no need to complete the base charge (charge and volume) or volumetric charge.

	Sewer Rate Structure	**Water Rate Structure**
Rate Structure:	Uniform	Uniform
Base Charge:	$16.86	$16.21
Thousands of Gallons in Base Charge:	0	0
Volumetric Charge per 1,000 gallons:	$4.84	$4.74
Monthly Bill for 5,000 gallons:	$41.06	$39.91
Combined Monthly Water and Sewer Bill for 5,000 gallons:	**$80.97**	
Median Household Income:	$62,362	
Monthly Median Household Income for LGU:	$5,197	
Bill as % of Median Household Income:	0.79%	0.77%
Overall Bill as % of Median Household Income:	**1.56%**	

Additional Information if needed (see Subchapter 8.1 of Part B of the guidance).

CFPUA's latest rate and fee schedule is included in Appendix Z.

Table 8.2. Funding Distribution

Southside Wastewater Treatment Plant Replacement & Capacity Upgrade Project

Cape Fear Public Utility Authority

Replacement and Capacity Upgrade

Enter data into the gray areas. Where applicable, use the pulldown menus as shown by the arrows.

	Funding Source[a]	Amount	Funding Type	Specified Interest Rate from LOIF[b] (if applicable)	Repayment Period (if applicable)
Main Division Funding:	CWSRF	$70,000,000	Loan	1.760%	20
Funding 1:	Other	$48,407,514	Cash	0.000%	0
Funding 2:	Bonds	$126,960,070	Loan	4.500%	25
	Closing/Administrative Fee(s):	$1,400,000			
	Total Funded Amount (minus applicable closing/administrative fee[s]):	**$245,367,584**			
	Total Project Cost (with closing/administrative fee[s]):	**$246,767,584**			

[a]For SRP grants, grant administrative fee is 1.5% of Total grant award.

For SRP and SRF loans, loan administrative fee is 2.0% of Total loan award.

[b]LOIF is Letter of Intent to Fund issued by the Division.

Table 8.3. Year 1 Interest and Repayment Southside Wastewater Treatment Plant Cape Fear Public Utility Authority Replacement & Capacity Upgrade Project					
	Funding Source	**Total Funding Amount**	**Year 1 Principal Payment**	**Year 1 Interest Payment**	**Year 1 Total Payment (Principal + Interest)**
Main DWI Funding:	CWSRF	$70,000,000	$3,500,000	$1,232,000	$4,732,000
Funding 1:	Other	$48,407,514			
Funding 2:	Bonds	$126,960,070	$5,078,403	$5,713,203	$10,791,606
Funding 3:					
Funding 4:					
Funding 5:					
				Total Payment @ Specified Interest Rate(s)[a]:	**$15,523,606**

[a] The interest rates are shown on Table 8.2.

Table 8.4. User Fee Increase Due to Project

Southside Wastewater Treatment Plant

Cape Fear Public Utility Authority

Replacement & Capacity Upgrade Project

Select Customer Type for Financing Project [c]	**Average Water Usage Per Month (gallons)**	**Number of Connections**	**Total Monthly Water Usage by Customer Type (gallons)**	Total Monthly Water Usage for Customer Base (gallons):	531,269,667
Residential	4,772	76,813	366,542,125	# of 5,000 Gallon Units to Finance Project:	106,254
Non-Residential	25,234	6,528	164,727,542	Year 1 O&M Expenses Due to Project:	$1,530,219

	Funding Source	**Year 1 Annual Repayment**	**Year 1 Annual O&M Costs**	**Total Year 1 Annual Costs @ Specified Interest Rate**	**Year 1 Monthly Costs @ Specified Interest Rate**	**Monthly Cost/ 5,000 Gallons Due to Project @ Specified Interest Rate (All Users)**	**Monthly Cost/5,000 Gallons Due to Project @ Specified Interest Rate (Residential Users Only)**
DWI Main Funding Source:	CWSRF	$4,732,000	$1,530,219	$6,262,219	$521,852	$4.91	$7.12
Funding Source 1:	Other						
Funding Source 2:	Bonds	$10,791,606		$10,791,606	$899,300	$8.46	$12.27
Funding Source 3:							
Funding Source 4:							
Funding Source 5:							
Total Year 1 Annual Cost @ Specified Interest Rate:				**$17,053,825**			
Total Year 1 Monthly Cost @ Specified Interest Rate:					**$1,421,152**		
Total Monthly Cost to Treat 5,000 Gallons @ Specified Interest Rate:						**$13.38**	
Total Monthly Cost to Treat 5,000 Gallons @ Specified Interest Rate (Residential Users Only):							**$19.39**

Table 8.5. Impacts to User Rates Southside Wastewater Treatment Plant Cape Fear Public Utility Authority Replacement & Capacity Upgrade Project			
Current Sewer Bill ($/5,000 gallons):	$41.06		
Current Water Bill ($/5,000 gallons):	$39.91		
Current - Combined Water & Sewer Bill ($/5,000 gallons):	$80.97		
	Funding Source	**User Rate Increase Due to Project @ Specified Interest Rate (All Users)**	**User Rate Increase Due to Project @ Specified Rate (Residential Users Only)**
Main IFS Funding Source:	CWSRF	$4.91	$7.12
Funding Source 1:	Other		
Funding Source 2:	Bonds	$8.46	$12.27
Funding Source 3:			
Funding Source 4:			
Funding Source 5:			
Total User Rate Increase Due to DWI Loan(s) ($/5,000 gal.):		**$4.91**	**$7.12**
Total Increase Due to All Loans(s) ($/5,000 gal.):		**$13.38**	**$19.39**
New Sewer Bill Due to DWI Loan(s) ($/5,000 gal.):		**$45.97**	**$48.18**
New Sewer Bill Due to All Loan(s) ($/5,000 gal.):		**$54.44**	**$60.45**
Percent Change in Sewer Bill Due to DWI Loan(s):		**11.96%**	**17.34%**
Percent Change in Sewer Bill Due to All Loan(s):		**32.57%**	**47.21%**
New Sewer & Water Bills Due to DWI Loan(s) ($/5,000 gal.):		**$85.88**	**$88.09**
New Water & Sewer Bills Due to All Loan(s) ($/5,000 gal.):		**$94.35**	**$100.36**
Percent Change in Sewer & Water Bills Due to DWI Loan(s):		**6.07%**	**6.07%**
Percent Change in Sewer & Water Bills Due to All Loan(s):		**16.52%**	**23.94%**

[a]Change in User Fee to finance DWI Loan.

[b]Change in User Fee to finance ALL funding sources.

Table 8.6. Impact to Bills Due to Project Southside Wastewater Treatment Plant Cape Fear Public Utility Authority Replacement & Capacity Upgrade Project					
Sewer Bill as % Monthly MHI:		0.79%	Water Bill as % Monthly MHI:		0.77%
Current Sewer Bill ($/5,000 gal.):		41.06	Current Water Bill ($/5,000 gal.):		$39.91
Current Sewer & Water Bill ($/5,000 gal.):		80.97	Sewer & Water Bill as % Monthly MHI:		1.56%
Monthly MHI for LGU:		$5,197			
		Sewer Bill Due to DWI Loans	**Sewer Bill Due to All Loans**	**Water & Sewer Bills Due to DWI Loans**	**Water & Sewer Bills Due to All Loans**
Specified Interest Rate (All Users)	New	$45.97	$54.44	$85.88	$94.35
	New %MHI Due to Project	0.88%	1.05%	1.65%	1.82%
	Potentially Significant Impact?	No	No	No	No
Specified Interest Rate (Residential Users Only)	New	$48.18	$60.45	$88.09	$100.36
	New %MHI Due to Project	0.93%	1.16%	1.70%	1.93%
	Potentially Significant Impact?	No	No	No	No
If the user fee increases will be significantly increased, discuss why the LGU has determined to proceed with the project.					
N/A					
If a different financial model has been used to determine project financing, then discuss how the Applicant will accommodate the project in terms of financing it.					
N/A					

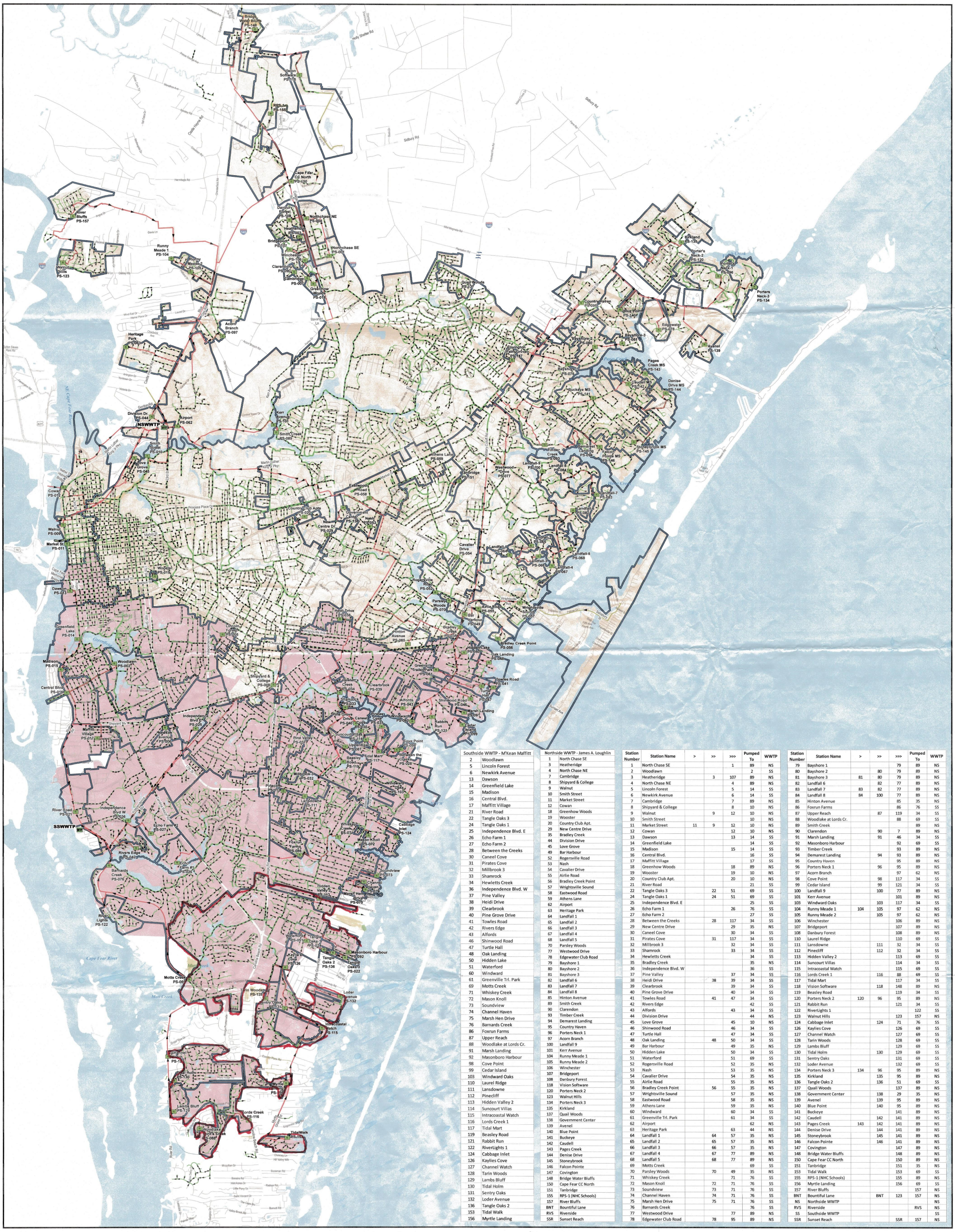
Section 9.0 Public Participation

The proposed project requires a FONSI and a high level of public involvement is required. The following steps will be completed after Division staff complete their reviews and any technical or environmental concerns have been addressed:

1. Advertise the public meeting
    a. A two-week notification will be advertised in a local newspaper whose coverage encompasses the project area. The advertisement will include the following information:
        i. Time and location of the public meeting
        ii. When and where a copy of the ER/EID can be reviewed
        iii. A brief description of the proposed project
        iv. The project cost and the amount of funding required
    b. A copy of the ER/EID will be available for review in an accessible location at least two weeks prior to the public meeting.
    c. A copy of the advertisement's affidavit of publication and the advertisement itself will be submitted once the public meeting has occurred.
2. Hold the public meeting
    a. A public meeting will be held. The following information will be disbursed:
        i. Need and purpose of the project
        ii. Discussion of alternatives
        iii. Identification of funding and amount of funding sought
        iv. Impact of the project on sewer bill for a typical residential user of 5,000 gallons per month
        v. Other relevant information such as benefits of other grants, interest rate benefit of Division programs, regulatory requirements, etc.
    b. Handouts or slides of the presentation will be distributed to attendees and submitted to the Division
3. Report on the public meeting
    a. Once the public meeting is completed, the following will be sent to the Environmental Review Coordinator:
        i. Copy of the affidavit of publication
        ii. Copy of the advertisement
        iii. Copy of the presentation
        iv. Minutes or detailed summary of the meeting

Appendix A

CFPUA Sewer Collection System Map



Southside WWTP - M'Kean Maffitt	
2	Woodlawn
5	Lincoln Forest
6	Newkirk Avenue
13	Dawson
14	Greenfield Lake
15	Madison
16	Central Blvd.
17	Maffitt Village
21	River Road
22	Tangle Oaks 3
24	Tangle Oaks 1
25	Independence Blvd. E
26	Echo Farm 1
27	Echo Farm 2
28	Between the Creeks
30	Caneel Cove
31	Pirates Cove
32	Millbrook 3
33	Shamrock
34	Hewletts Creek
36	Independence Blvd. W
37	Pine Valley
38	Heidi Drive
39	Clearbrook
40	Pine Grove Drive
41	Towles Road
42	Rivers Edge
43	Alfords
46	Shinwood Road
47	Turtle Hall
48	Oak Landing
50	Hidden Lake
51	Waterford
60	Windward
61	Greenville Trl. Park
69	Motts Creek
71	Whiskey Creek
72	Mason Knoll
73	Soundview
74	Channel Haven
75	Marsh Hen Drive
76	Barnards Creek
86	Foxrun Farms
87	Upper Reach
88	Woodlake at Lords Cr.
91	Marsh Landing
92	Masonboro Harbour
98	Cove Point
99	Cedar Island
103	Windward Oaks
110	Laurel Ridge
111	Lansdowne
112	Pinecliff
113	Hidden Valley 2
114	Suncourt Villas
115	Intracoastal Watch
116	Lords Creek 1
117	Tidal Mart
119	Beasley Road
121	Rabbit Run
122	RiverLights 1
124	Cabbage Inlet
126	Kaylies Cove
127	Channel Watch
128	Tarin Woods
129	Lambs Bluff
130	Tidal Holm
131	Sentry Oaks
132	Loder Avenue
136	Tangle Oaks 2
153	Tidal Walk
156	Myrtle Landing

Northside WWTP - James A. Loughlin	
1	North Chase SE
3	Heatheridge
4	North Chase NE
7	Cambridge
8	Shipyard & College
9	Walnut
10	Smith Street
11	Market Street
12	Cowan
18	Greenhow Woods
19	Wooster
20	Country Club Apt.
29	New Centre Drive
35	Bradley Creek
44	Division Drive
45	Love Grove
49	Bar Harbour
52	Rogersville Road
53	Nash
54	Cavalier Drive
55	Airlie Road
56	Bradley Creek Point
57	Wrightsville Sound
58	Eastwood Road
59	Athens Lane
62	Airport
63	Heritage Park
64	Landfall 1
65	Landfall 2
66	Landfall 3
67	Landfall 4
68	Landfall 5
70	Parsley Woods
77	Westwood Drive
78	Edgewater Club Road
79	Bayshore 1
80	Bayshore 2
81	Bayshore 3
82	Landfall 6
83	Landfall 7
84	Landfall 8
85	Hinton Avenue
89	Smith Creek
90	Clarendon
93	Timber Creek
94	Demarest Landing
95	Country Haven
96	Porters Neck 1
97	Acorn Branch
100	Landfall 9
101	Kerr Avenue
104	Runny Meade 1
105	Runny Meade 2
106	Winchester
107	Bridgeport
108	Danbury Forest
118	Vision Software
120	Porters Neck 2
123	Walnut Hills
134	Porters Neck 3
135	Kirkland
137	Quail Woods
138	Government Center
139	Avenel
140	Blue Point
141	Buckeye
142	Caudell
143	Pages Creek
144	Denise Drive
145	Stoneybrook
146	Falcon Pointe
147	Covington
148	Bridge Water Bluffs
150	Cape Fear CC North
151	Tanbridge
155	RPS-1 (NHC Schools)
157	River Bluffs
BNT	Bountiful Lane
RVS	Riverside
SSR	Sunset Reach

Station Number	Station Name	>	>>	>>>	Pumped To	WWTP
1	North Chase SE			1	89	NS
2	Woodlawn				2	SS
3	Heatheridge		3	107	89	NS
4	North Chase NE			4	89	NS
5	Lincoln Forest			5	14	SS
6	Newkirk Avenue			6	14	SS
7	Cambridge			7	89	NS
8	Shipyard & College			8	10	NS
9	Walnut		9	12	10	NS
10	Smith Street				10	NS
11	Market Street	11	9	12	10	NS
12	Cowan			12	10	NS
13	Dawson			13	14	SS
14	Greenfield Lake				14	SS
15	Madison			15	14	SS
16	Central Blvd.				16	SS
17	Maffitt Village				17	SS
18	Greenhow Woods			18	89	NS
19	Wooster			19	10	NS
20	Country Club Apt.			20	10	NS
21	River Road				21	SS
22	Tangle Oaks 3		22	51	69	SS
24	Tangle Oaks 1		24	51	69	SS
25	Independence Blvd. E				25	SS
26	Echo Farm 1			26	76	SS
27	Echo Farm 2				27	SS
28	Between the Creeks		28	117	34	SS
29	New Centre Drive			29	35	NS
30	Caneel Cove			30	34	SS
31	Pirates Cove	31		117	34	SS
32	Millbrook 3			32	34	SS
33	Shamrock			33	34	SS
34	Hewletts Creek				34	SS
35	Bradley Creek				35	NS
36	Independence Blvd. W				36	SS
37	Pine Valley			37	34	SS
38	Heidi Drive	38		39	34	SS
39	Clearbrook			39	34	SS
40	Pine Grove Drive			40	34	SS
41	Towles Road	41		47	34	SS
42	Rivers Edge				42	SS
43	Alfords			43	34	SS
44	Division Drive				44	NS
45	Love Grove			45	10	NS
46	Shinwood Road			46	34	SS
47	Turtle Hall			47	34	SS
48	Oak Landing	48		50	34	SS
49	Bar Harbour			49	35	NS
50	Hidden Lake			50	34	SS
51	Waterford			51	69	SS
52	Rogersville Road			52	35	NS
53	Nash			53	35	NS
54	Cavalier Drive			54	35	NS
55	Airlie Road			55	35	NS
56	Bradley Creek Point	56		55	35	NS
57	Wrightsville Sound			57	35	NS
58	Eastwood Road			58	35	NS
59	Athens Lane			59	35	NS
60	Windward			60	34	SS
61	Greenville Trl. Park			61	34	SS
62	Airport				62	NS
63	Heritage Park			63	44	NS
64	Landfall 1	64		57	35	NS
65	Landfall 2	65		57	35	NS
66	Landfall 3	66		57	35	NS
67	Landfall 4	67		77	89	NS
68	Landfall 5	68		77	89	NS
69	Motts Creek				69	SS
70	Parsley Woods	70		49	35	NS
71	Whiskey Creek			71	76	SS
72	Mason Knoll	72		71	76	SS
73	Soundview	73		71	76	SS
74	Channel Haven	74		71	76	SS
75	Marsh Hen Drive	75		71	76	SS
76	Barnards Creek				76	SS
77	Westwood Drive			77	89	NS
78	Edgewater Club Road	78		95	89	NS

Station Number	Station Name	>	>>	>>>	Pumped To	WWTP
79	Bayshore 1			79	89	NS
80	Bayshore 2		80	79	89	NS
81	Bayshore 3	81	80	79	89	NS
82	Landfall 6		82	77	89	NS
83	Landfall 7	83	82	77	89	NS
84	Landfall 8	84	100	77	89	NS
85	Hinton Avenue			85	35	NS
86	Foxrun Farms			86	76	SS
87	Upper Reach		87	119	34	SS
88	Woodlake at Lords Cr.			88	69	SS
89	Smith Creek				89	NS
90	Clarendon		90	7	89	NS
91	Marsh Landing		91	46	34	SS
92	Masonboro Harbour			92	69	SS
93	Timber Creek			93	89	NS
94	Demarest Landing		94	93	89	NS
95	Country Haven			95	89	NS
96	Porters Neck 1		96	95	89	NS
97	Acorn Branch			97	62	NS
98	Cove Point		98	117	34	SS
99	Cedar Island		99	121	34	SS
100	Landfall 9		100	77	89	NS
101	Kerr Avenue			101	89	NS
103	Windward Oaks		103	117	34	SS
104	Runny Meade 1	104	105	97	62	NS
105	Runny Meade 2		105	97	62	NS
106	Winchester			106	89	NS
107	Bridgeport			107	89	NS
108	Danbury Forest			108	89	NS
110	Laurel Ridge			110	69	SS
111	Lansdowne		111	32	34	SS
112	Pinecliff		112	32	34	SS
113	Hidden Valley 2			113	69	SS
114	Suncourt Villas			114	34	SS
115	Intracoastal Watch			115	69	SS
116	Lords Creek 1		116	88	69	SS
117	Tidal Mart			117	34	SS
118	Vision Software		118	148	89	NS
119	Beasley Road			119	34	SS
120	Porters Neck 2	120	96	95	89	NS
121	Rabbit Run			121	34	SS
122	RiverLights 1				122	SS
123	Walnut Hills			123	157	NS
124	Cabbage Inlet		124	71	76	SS
126	Kaylies Cove			126	69	SS
127	Channel Watch			127	69	SS
128	Tarin Woods			128	69	SS
129	Lambs Bluff			129	69	SS
130	Tidal Holm		130	129	69	SS
131	Sentry Oaks			131	69	SS
132	Loder Avenue			132	69	SS
134	Porters Neck 3	134	96	95	89	NS
135	Kirkland		135	95	89	NS
136	Tangle Oaks 2		136	51	69	SS
137	Quail Woods			137	89	NS
138	Government Center		138	29	35	NS
139	Avenel		139	95	89	NS
140	Blue Point		140	95	89	NS
141	Buckeye			141	89	NS
142	Caudell		142	141	89	NS
143	Pages Creek	143	142	141	89	NS
144	Denise Drive		144	141	89	NS
145	Stoneybrook		145	141	89	NS
146	Falcon Pointe		146	141	89	NS
147	Covington			147	89	NS
148	Bridge Water Bluffs			148	89	NS
150	Cape Fear CC North			150	89	NS
151	Tanbridge			151	35	NS
153	Tidal Walk			153	69	SS
155	RPS-1 (NHC Schools)			155	89	NS
156	Myrtle Landing			156	69	SS
157	River Bluffs				157	NS
BNT	Bountiful Lane		BNT	123	157	NS
NS	Northside WWTP					NS
RVS	Riverside				RVS	NS
SS	Southside WWTP					SS
SSR	Sunset Reach			SSR	157	NS

Gravity Mains
- 8" or Less (or Unknown)
- 10" - 18"
- 20" - 48"

Force Mains
- CFPUA, Active
- CFPUA, Inactive
- CFPUA, Proposed
- Private, Active

- Pump Station
- Treatment Plant
- NSWWTP
- SSWWTP

CFPUA Sewer System

4/30/2019

Sensitive Public Security Information Non-Releasable per NCGS 132-1.7

0 1,200 2,400 4,800 7,200 9,600 Feet

1 inch = 2,400 feet

N W E S

NDH Date Saved: 4/30/2019
S:\Engineers\GIS_Maps\2019_System_Maps\2019_Sewer_Map_36x48.mxd

Appendix B

CFPUA 2022-2023 Wastewater System Performance Report

Cape Fear Public Utility Authority

2022-2023 Wastewater System Performance Report

Wastewater System Overview

Cape Fear Public Utility Authority (CFPUA) is the primary wastewater services provider for New Hanover County and the city of Wilmington, serving more than 74,000 individual homes, businesses, and other properties. CFPUA operates and maintains two wastewater treatment plants (WWTP), 158 pump stations, and over 1,100 miles of sewer mains. In fiscal year (FY) 2023, which spanned from July 2022 to June 2023, CFPUA collected and treated approximately 6.2 billion gallons of wastewater. CFPUA spent $12.2 million to operate and maintain the wastewater system and invested another $21 million in system growth and capital upgrades, repairs, and replacements of aging infrastructure.

Biosolids Management

Beginning in 2019, CFPUA transitioned to an in-house managed wastewater residuals program. CFPUA's managed residuals program consists of dewatering, contracted hauling of dewatered residuals, and landfill disposal. Landfill disposal is expected to continue due to the presence of PFAS in the dewatered residuals. Below is the FY 2023 program by the numbers for Southside WWTP, Northside WWTP, and the alum sludge processed for Sweeney Water Treatment Plant:

- Total CFPUA Production: 25,988 wet tons
- Total Landfill Disposal: 23,302 wet tons/990 loads hauled
- Total Processing Runtime: 6,052 hours

Treatment Plant Information

James A. Loughlin (Northside) WWTP
2311 N. 23rd St., Wilmington, NC 28401
Permitted Capacity: 16 million gallons/day

M'Kean Maffit (Southside) WWTP
3436 River Rd., Wilmington, NC 28412
Permitted Capacity: 12 million gallons/day

Wastewater System Contacts

Geoffrey Cermak, ORC
(910) 332-6562
James A. Loughlin (Northside) WWTP
Permit No. NC0023965

Steven Styers, ORC
(910) 332-6578
M'Kean Maffitt (Southside) WWTP
Permit No. NC0023973

Robert Daughtry, ORC
(910) 332-6637
Collections System Superintendent
Permit No. WQCS00012

NPDES Permit Summary July 2022–June 2023

No violations of the NPDES permit limits for both the James A. Loughlin (Northside) and M'Kean Maffit (Southside) WWTPs.

Cape Fear Public Utility Authority

2022-2023 Wastewater System Performance Report

Sanitary Sewer Overflows (SSOs)

SSO Month	Incident Start Date	Total Volume Spilled (Gallons)	Volume To Surface Water (Gallons)	Watershed	Location	Probable Cause	Enforcement Action
August	8/1/2022	2,340	0	Pages Creek	535 Middle Sound Loop Rd	Pipe failure	Notice of Deficiency
October	10/1/2022	1,050	0	Barnards Creek	Manhole at 4112 Echo Farms Blvd	Blockage due to grease and debris	Notice of Deficiency
December	12/26/2022	800	800	Cape Fear River	2 Dawson St	Equipment failure	Notice of Violation
January	1/12/2023	610	610	Bradley Creek	117 Hidden Lake Ln	Pipe failure	Notice of Violation
January	1/26/2023	510	510	Burnt Mill Creek	4360 Randall Pkwy	Debris in line	Notice of Violation
April	4/24/2023	3,000	2,000	Hewletts Creek	5609 Whisper Creek Ln	Pipe failure	Notice of Deficiency

*No civil penalties were given to CFPUA for the above SSO enforcement

Wastewater System Maintenance Overview

- Collection system gravity sewer mains cleaned: 124.83miles
- Gravity mains inspected with CCTV: 26.34 miles
- Preventive maintenance work orders completed at pump stations: 8,099
- Corrective and emergency work orders at pump stations: 66

Protect Our Pipes!

FOG (fats, oils, and grease) is found in many foods and cooking products and can cause major problems for our sewer system. FOG does not break down easily and builds up in pipes, causing blockages that can lead to SSOs. Proper disposal will help avoid costly sewer overflows, higher utility costs, and harm to the environment. Please remember to never flush any product other than toilet paper.

Cape Fear Public Utility Authority

2022-2023 Wastewater System Performance Report

NACWA Gold Peak Performance Award

Both of CFPUA's wastewater treatment plants received the National Association of Clean Water Agencies (NACWA) Gold Peak Performance Award for calendar year (CY) 2022. This award recognizes NACWA member facilities with zero permit violations for the calendar year. Both facilities received this award last calendar year (CY 2021) as well.

AMWA Gold Award for Exceptional Utility Performance

In October of 2022, CFPUA received the Association of Metropolitan Water Agencies (AMWA) Gold Award for Exceptional Utility Performance. This award recognizes member water systems that demonstrate "high levels of performance in the areas of product quality, customer satisfaction, employee and leadership development, operational optimization, financial viability, community sustainability, enterprise resiliency, infrastructure strategy and performance, stakeholder understanding and support, and water resource sustainability." For more information please go to: https://www.amwa.net/

Certification and Availability Statements

CFPUA certifies under penalty of law that this report is complete and accurate to the best of staff knowledge. CFPUA further certifies that this report has been made available to the users and customers of the CFPUA system and that those users have been notified of the report availability.

Notification of availability of this report is provided through printed notice on water and sewer bills and on the CFPUA website. This report was completed by CFPUA staff and is accurate to the best of their knowledge and belief.

Copies of this report are available at:

- 235 Government Center Dr
- 305 Chestnut St
- www.cfpua.org

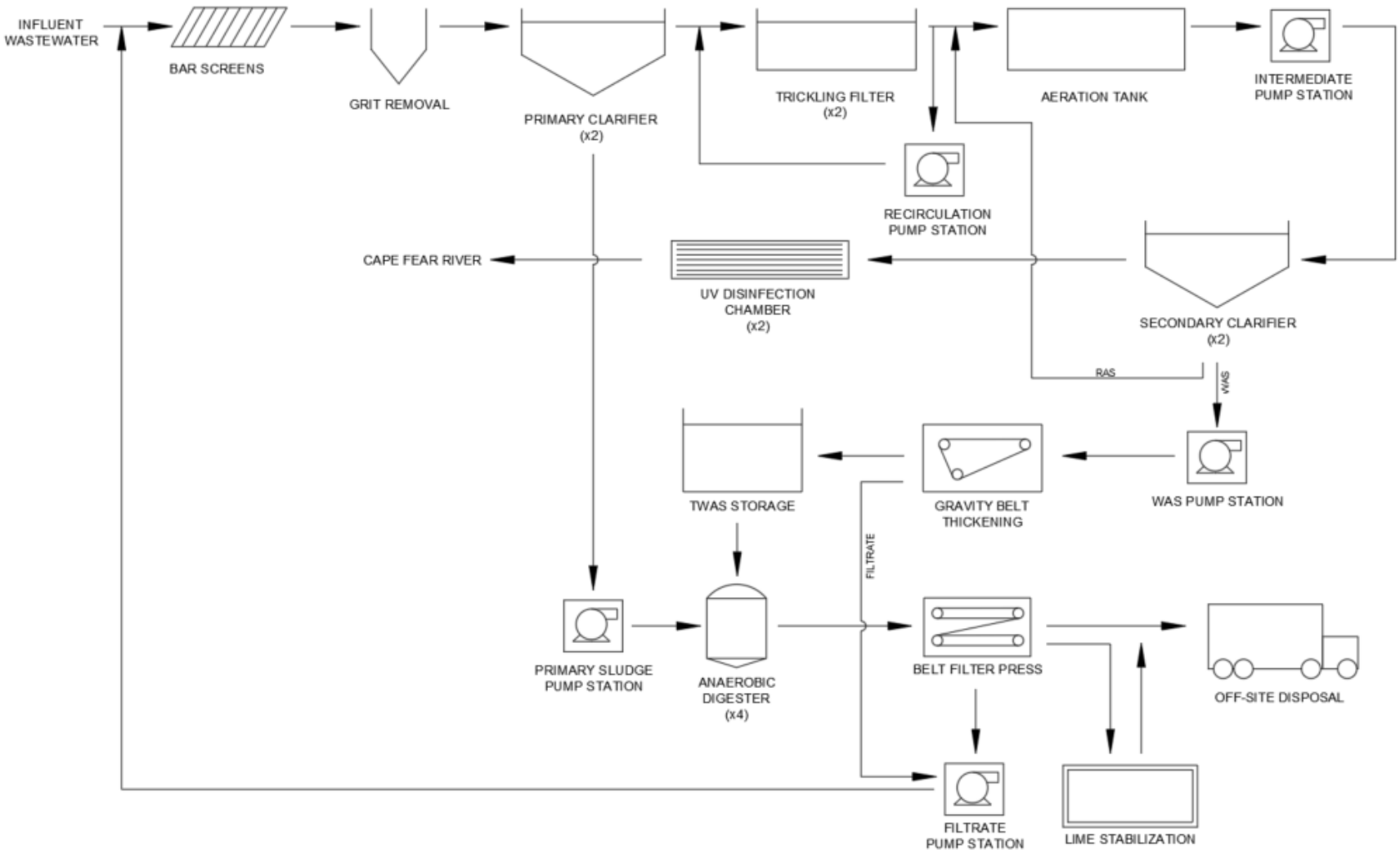






Appendix C

Existing CFPUA SSWWTP Process Flow Diagram & Site Plan


INFLUENT WASTEWATER
BAR SCREENS
GRIT REMOVAL
PRIMARY CLARIFIER (x2)
TRICKLING FILTER (x2)
AERATION TANK
INTERMEDIATE PUMP STATION
RECIRCULATION PUMP STATION
CAPE FEAR RIVER
UV DISINFECTION CHAMBER (x2)
SECONDARY CLARIFIER (x2)
RAS
WAS
TWAS STORAGE
GRAVITY BELT THICKENING
WAS PUMP STATION
FILTRATE
PRIMARY SLUDGE PUMP STATION
ANAEROBIC DIGESTER (x4)
BELT FILTER PRESS
OFF-SITE DISPOSAL
FILTRATE PUMP STATION
LIME STABILIZATION


SECONDARY CLARIFIERS
TRICKLING FILTERS
PRIMARY CLARIFIERS
PRIMARY SLUDGE PUMP STATION
HEADWORKS
INTERMEDIATE PUMP STATION
ODOR CONTROL
UV DISINFECTION
ANAEROBIC DIGESTERS
DISCHARGE
WAS PUMP STATION
TWAS STORAGE
RECIRCULATION PUMP STATION
BIOSOLIDS BUILDING
AERATION TANK
FILTRATE PUMP STATION
LIME STABILIZATION AREA
150
0
150'

Appendix D

NPDES Permit No. NC0023973

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

ROY COOPER
Governor
ELIZABETH S. BISER
Secretary
RICHARD E. ROGERS, JR.
Director

NORTH CAROLINA
Environmental Quality

October 4, 2022

Mr. Kenneth Waldroup, Executive Director
Cape Fear Public Utility Authority
235 Government Center Dr
Wilmington, NC 28403

Subject: Final NPDES Permit Renewal
Permit NC0023973
M'Kean Maffitt (Southside) WWTP
New Hanover County
Grade IV Biological WPCS
SIC Code 4952

Dear Mr. Waldroup:

Division personnel have reviewed and approved your application for renewal of the subject permit. Accordingly, we are forwarding the attached NPDES permit. This permit is issued pursuant to the requirements of North Carolina General Statute 143-215.1 and the Memorandum of Agreement between North Carolina and the U.S. Environmental Protection Agency dated October 15, 2007 (or as subsequently amended).

No changes were made to the draft sent to you on August 9, 2022. This letter addresses the comments made by CPFUA on September 14, 2022:

- Language in the second bullet pertaining to reduced monitoring frequencies has been corrected to match the permit (see below). Please note that Ammonia monitoring frequency was not reduced as there are no limits to evaluate effluent data against.
- Dissolved Oxygen (DO) limit of ≤ 5 mg/L added to the permit reflects the stream standard for Class SC tidal salt waters per 15A NCAC 02B .0220. Further, it was added in recognition that the receiving water is impaired for DO.

This final permit maintains the following significant changes identified in the letter sent on August 9, 2022:

- The system component list on the Supplement to Cover Sheet has been revised based on communication with facility staff, including the replacement of chlorination-dechlorination system with a UV disinfection system.
- Based on your request and NPDES guidance regarding the reduction of monitoring frequencies in NPDES permits for exceptionally performing facilities, monitoring requirements for $CBOD_5$, Total Suspended Solids and Enterococci will continue reduced at twice per week for the 12.0 MGD flow tier [See A. (1.)].

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

- Based on the reasonable potential analysis (RPA) showing no reasonable potential to violate state water quality standards using revised dilution factors from the 2018 JP-EFDC dilution model, the monitoring requirements for Total Phenolic Compounds, Total Copper (including limits) and Total Silver have been removed from the permit [see A. (1.) – A. (4.)].
- Based on the removal of Total Copper limits and monitoring, the copper compliance schedule has been removed from the permit.
- Based on the RPA showing reasonable potential to violate state water quality standards with a limited dataset (n < 8 samples), quarterly monitoring for Bis(2-ethylhexyl) phthalate has been added to the permit at 16.0, 20.0 and 24.0 MGD expansion flow tiers [see A. (2.) – A. (4.)].
- Based on Mercury TMDL evaluation showing mercury detectable values reported at levels > 1 ng/L and since the permitted flow is greater than 2 MGD, the Mercury Minimization Plan special condition has been reworded toward its maintenance [see A. (7.)].
- Based on the facility treating industrial wastewater, conductivity effluent monitoring has been added to the permit.
- Based on the results of the 2018 JP-EFDC dilution model results, the Chronic Toxicity test limits have been revised at all flow tiers [see A. (1.) – A. (5.)].
- Some of the wording has changed in Special Condition A. (5.), Chronic Toxicity Permit Limit, please review each paragraph carefully.
- Special Condition A. (6.) has been modified to include the specific three years in which the Effluent Pollutant Scan shall be performed (2023, 2024, and 2025). In addition, some of the wording in the 2nd species Toxicity Testing requirements section has been changed. Please read each paragraph carefully.
- A notation was made concerning the Electronic Reporting Rule – NPDES Electronic Reporting Rule – Phase 2 Extension. EPA extended the Phase 2 deadline to December 21, 2025.
- Federal regulations require electronic submittal of all discharge monitoring reports (DMRs) and program reports. The requirement to continue reporting discharge monitoring data electronically using the NC DWR's Electronic Discharge Monitoring Report (eDMR) internet application has been added to your NPDES permit [See A. (10.)].
- Parameter codes have been added to the Effluent Limitations and Monitoring Requirements and Effluent Pollutant Scan [See A. (1.) – A. (4.) and A. (6.)].
- Regulatory citations have been added to the permit.

Pretreatment updates in response to NPDES permit renewal:

- On April 30, 2023, 180 days after the effective date of this NPDES permit renewal, the Town is required to submit to the Division a written technical evaluation of the need to revise local limits (i.e., an updated IWS/HWA-AT/L-LTMP, or documentation of why is not needed). This action may include revising, updating, or adding to the list of SIUs regardless of timeframe.
    - Submit the updated Long-Term Monitoring Plan (LTMP)
        - If there are new industries within the service area, submit an updated Industrial Waste Survey (IWS)
        - Review pollutants of concern (POCs) and update the LTMP to reflect pollutants in industrial user permits (IUPs) and sludge management permit.
        - Update the POC PQLs to recommended levels:
            - Cadmium (Cd) at 0.5 µg/L
            - Molybdenum (Mo) at 10.0 at µg/L

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

- As part of the local limits assessment, please submit the updated Headworks Analysis (HWA).

The NPDES standard conditions (Parts II, III, and IV) that are a part of the permit are not included in this draft document (cover, map, and Part I). The conditions are the same as in your current permit except that agency and division names have been updated. The latest version is available at https://bit.ly/3k5NFaL and can be viewed online or downloaded as a PDF file.

If any parts, measurement frequencies or sampling requirements contained in this permit are unacceptable to you, you have the right to an adjudicatory hearing upon written request within thirty (30) days following receipt of this letter. This request must be in the form of a written petition, conforming to Chapter 150B of the North Carolina General Statutes, and filed with the Office of Administrative Hearings (6714 Mail Service Center, Raleigh, North Carolina 27699-6714). Unless such demand is made, this decision shall be final and binding.

The NPDES standard conditions (Parts II, III, and IV) are the same as in your current permit except that agency and division names have been updated. The latest version is available at https://bit.ly/3k5NFaL and can be viewed online or downloaded as a PDF file.

Please note that this permit is not transferable except after notice to the Division. The Division may require modification or revocation and reissuance of the permit. This permit does not affect the legal requirements to obtain other permits which may be required by the Division of Water Resources or any other Federal, State, or Local governmental regulations.

If you have any questions concerning this permit, please contact Gary Perlmutter at (919) 707-3611 or via email at gary.perlmutter@ncdenr.gov.

Sincerely,

DocuSigned by:
Michael Montebello
C464531431644FE...

for Richard E. Rogers Jr., Director
Division of Water Resources, NCDEQ

Hardcopy: NPDES Files

eCopy: US EPA Region 4
DWR / Wilmington Regional Office / Water Quality / Morella S. King
DWR / Wilmington Regional Office / Pretreatment / Helen Perez
DWR / Operator Certification Program / Maureen Kinney
DWR / Ecosystems Branch / Mark Vander Borgh
DWR / Aquatic Toxicology Branch / Cindy Moore
DWR / Municipal Permitting Unit / Pretreatment / Keyes McGee
DWR / Basin Planning Branch / Nora Deamer
CFPUA / Beth Eckert

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER RESOURCES

PERMIT

TO DISCHARGE WASTEWATER UNDER THE

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provision of North Carolina General Statute 143-215.1, other lawful standards and regulations promulgated and adopted by the North Carolina Environmental Management Commission, and the Federal Water Pollution Control Act, as amended, the

Cape Fear Public Utility Authority

is hereby authorized to discharge wastewater from a facility located at the

M'Kean Maffitt (Southside) WWTP
3436 River Road
Wilmington, NC 28412
New Hanover County

to receiving waters designated as Cape Fear River in the Cape Fear River Basin in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Parts I, II, III and IV hereof.

This permit shall become effective November 1, 2022.

This permit and authorization to discharge shall expire at midnight on November 30, 2026.

Signed this day October 4, 2022.

DocuSigned by:
Michael Montebello
C464531431644FE...

for Richard E. Rogers, Jr., Director
Division of Water Resources
By Authority of the Environmental Management Commission

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

SUPPLEMENT TO PERMIT COVER SHEET

All previous NPDES Permits issued to this facility, whether for operation or discharge, are hereby revoked. As of this permit issuance, any previously issued permit bearing this number is no longer effective. Therefore, the exclusive authority to operate and discharge from this facility arises under the permit conditions, requirements, terms, and provisions included herein.

The Cape Fear Public Authority is hereby authorized to:

1. Continue to operate an existing **12.0 MGD** wastewater treatment system consisting of the following:

   - Influent metering
   - Standby manual bar screens
   - Dual mechanical bar screens, each with grit removal and storage unit
   - Splitter box
   - Dual primary clarifiers
   - Dual trickling filters (180 feet diameter)
   - Short-term aeration basin
   - Splitter box
   - Three screw lift pumps
   - Dual secondary clarifiers
   - Return activated sludge pumping station
   - Dual UV chambers
   - Outfall structure with flow meter
   - Main plant backup generator
   - Lift-station generator, automatically activated (with backup generator)
   - Primary and waste-activated sludge pump stations
   - Two gravity-belt thickeners, two belt filter presses; four anaerobic digesters; covered storage area
   - Solids land application

   The facility is located at the M'Kean Maffitt (Southside) WWTP, 3436 River Road, Wilmington in New Hanover County.

2. After receiving an Authorization to Construct from the Division, construct and operate facilities giving the system a treatment capacity of 16.0 MGD; and

3. After receiving an Authorization to Construct from the Division, construct and operate facilities giving the system a treatment capacity of 20.0 MGD; and

4. After receiving an Authorization to Construct from the Division, construct and operate facilities giving the system an ultimate treatment capacity of 24.0 MGD; and

5. Discharge from said treatment facility through Outfall 001 at the location specified on the attached map into the Cape Fear River, classified as a Class SC-PNA stream in the Cape Fear River Basin.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

PART I

A. (1.) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (12.0 MGD)

[15A NCAC 02B .0400 et seq., 02B .0500 et seq.] **Grade IV Biological Water Pollution Control System** [15A NCAC 08G .0302]

a. During the period beginning on the effective date and lasting until **expansion above 12.0 MGD (and receipt of the Engineer's Certification of completion)**, the Permittee is authorized to discharge **treated wastewater** from **Outfall 001**. Such discharges shall be limited and monitored [1] by the Permittee as specified below:

EFFLUENT CHARACTERISTICS		LIMITS			MONITORING REQUIREMENTS		
	Parameter Code	**Monthly Average**	**Weekly Average**	**Daily Maximum**	**Measurement Frequency**	**Sample Type**	**Sample Location [2]**
Flow	*50050*	12.0 MGD			Continuous	Recording	Influent or Effluent
CBOD, 5-day, 20ºC [3]	*80082*	25.0 mg/L	40.0 mg/L		2/Week [4]	Composite	Influent and Effluent
Total Suspended Solids (TSS) [3]	*CO530*	30.0 mg/L	45.0 mg/L		2/Week [4]	Composite	Influent and Effluent
Ammonia–N (NH_3-N) (mg/L)	*CO610*	Monitor and Report			3/Week	Composite	Effluent
Enterococci (geometric mean)	*61211*	35/100 mL	276/100 mL		2/Week [4]	Grab	Effluent
Total Residual Chlorine (TRC) [5]	*50060*			13.0 µg/L	Daily	Grab	Effluent
Temperature (ºC)	*00010*	Monitor and Report			Daily	Grab	Effluent
pH	*00400*	Between 6.8 and 8.5 Standard Units			3/Week	Grab	Effluent
Dissolved Oxygen (DO) (mg/L)	*00300*	Daily average ≥ 5.0 mg/L			Daily	Grab	Effluent
Conductivity (µmhos/cm)	*00094*	Monitor and Report			Daily	Grab	Effluent
Total Nitrogen (mg/L) [6]	*CO600*	Monitor and Report			Monthly	Composite	Effluent
Total Phosphorus (mg/L)	*CO665*	Monitor and Report			Monthly	Composite	Effluent
Chronic Toxicity [7]	*TGP3B*	*Ceriodaphnia dubia* Pass/Fail at 3.8% effluent			Quarterly	Composite	Effluent
Effluent Pollutant Scan	*NC01*	Monitor and Report			Footnote 8	Footnote 8	Effluent
Dissolved Oxygen (DO) (mg/L) [9]	*00300*	Monitor and Report			Variable [10]	Grab	Upstream, Downstream
Temperature (ºC) [9]	*00010*	Monitor and Report			Variable [10]	Grab	Upstream, Downstream
Conductivity (µmhos/cm) [9]	*00094*	Monitor and Report			Variable [10]	Grab	Upstream, Downstream

Footnotes on next page.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

Footnotes:

1. Submit discharge monitoring reports electronically using NC DWR's eDMR application system; see Special Condition A. (10.).
2. Upstream is at a point equidistant between the radio tower north of the WWTP and the northern end of the dredge spoil island immediately east of the outfall. Downstream is at a point equidistant between the mouth of Barnards Creek and the southern end of the dredge spoil island immediately east of the outfall.
3. The monthly average effluent $CBOD_5$ and TSS concentrations shall not exceed 15% of the respective influent value (85% removal).
4. Twice per week sampling must occur on any two non-consecutive days during the calendar week.
5. The facility shall monitor TRC when using chlorination for disinfection. The Division shall consider all effluent total residual chlorine values reported below 50 µg/L to be in compliance with the permit. However, the Permittee shall continue to record and submit all values reported by a North Carolina certified laboratory (including field-certified), even if these values fall below 50 µg/L.
6. Total Nitrogen = TKN + NO_3-N + NO_2-N, where TKN is Total Kjeldahl Nitrogen, NO_3-N is Nitrate Nitrogen, and NO_2-N is Nitrite Nitrogen.
7. Whole Effluent Toxicity shall be monitored using the Pass/Fail Chronic Toxicity test with *Ceriodaphnia dubia* at 3.8% effluent. Samples shall be taken in *March, June, September* & *December*; see Special Condition A. (5.).
8. The Permittee shall perform three Effluent Pollutant Scans during the term of this permit; see Special Condition A. (6.).
9. Instream monitoring for all parameters is provisionally waived considering the Permittee's participation in the Lower Cape Fear River Program. Instream monitoring shall be immediately reinstated, and the Division shall be notified immediately should the Permittee end its participation in the Program.
10. Stream samples shall be collected 3/week from June 1 through September 30, and collected weekly from October 1 through May 31.

b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

A. (2.) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (16.0 MGD) [15A NCAC 02B .0400 et seq., 02B .0500 et seq.] **Grade IV Biological Water Pollution Control System** [15A NCAC 08G .0302]

a. Beginning upon receipt of the Engineer's Certification of completion of the 16.0 MGD expansion and lasting until **expansion above 16.0 MGD (and receipt of the Engineer's Certification of completion)** or permit expiration, the Permittee is authorized to discharge **treated wastewater** from **Outfall 001**. Such discharges shall be limited and monitored [1] by the Permittee as specified below:

EFFLUENT CHARACTERISTICS		LIMITS			MONITORING REQUIREMENTS		
	Parameter Code	Monthly Average	Weekly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location [2]
Flow	*50050*	16.0 MGD			Continuous	Recording	Influent or Effluent
BOD, 5-day, 20ºC (Apr 1 – Oct 31) [3]	*CO310*	5.0 mg/L	7.5 mg/L		Daily	Composite	Influent and Effluent
BOD, 5-day, 20ºC (Nov 1 – Mar 31) [3]	*CO310*	10.0 mg/L	15.0 mg/L		Daily	Composite	Influent and Effluent
Total Suspended Solids (TSS) [3]	*CO530*	10.0 mg/L	15.0 mg/L		Daily	Composite	Influent and Effluent
NH_3–N (Apr 1 – Oct 31)	*CO610*	1.0 mg/L	3.0 mg/L		Daily	Composite	Effluent
NH_3–N (Nov 1 – Mar 31)	*CO610*	2.0 mg/L	6.0 mg/L		Daily	Composite	Effluent
Enterococci (geometric mean)	*61211*	35/100 mL	276/100 mL		Daily	Grab	Effluent
Total Residual Chlorine (TRC) [4]	*50060*			13.0 µg/L	Daily	Grab	Effluent
Temperature (ºC)	*00010*	Monitor and Report			Daily	Grab	Effluent
pH	*00400*	Between 6.8 and 8.5 Standard Units			Daily	Grab	Effluent
Dissolved Oxygen (DO)	*00300*	Daily average ≥ 6.0 mg/L			Daily	Grab	Effluent
Conductivity (µmhos/cm)	*00094*	Monitor and Report			Daily	Grab	Effluent
Total Nitrogen (mg/L) [5]	*CO600*	Monitor and Report			Monthly	Composite	Effluent
Total Phosphorus (mg/L)	*CO665*	Monitor and Report			Monthly	Composite	Effluent
Bis(2-Ethylhexyl) Phthalate (µg/L)	*39100*	Monitor and Report			Quarterly	Grab	Effluent
Chronic Toxicity [6]	*NC01*	*Ceriodaphnia dubia* Pass/Fail at 4.5% effluent			Quarterly	Composite	Effluent
Effluent Pollutant Scan	*00300*	Monitor and Report			Footnote 7	Footnote 7	Effluent
Dissolved Oxygen (DO) (mg/L) [8]	*00010*	Monitor and Report			Variable [9]	Grab	Upstream, Downstream
Temperature (ºC) [8]	*00094*	Monitor and Report			Variable [9]	Grab	Upstream, Downstream
Conductivity (µmhos/cm)	*00094*	Monitor and Report			Variable [9]	Grab	Upstream, Downstream

Footnotes on next page.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

Footnotes:

1. Submit discharge monitoring reports electronically using NC DWR's eDMR application system; see Special Condition A. (10.).
2. Upstream is at a point equidistant between the radio tower north of the WWTP and the northern end of the dredge spoil island immediately east of the outfall. Downstream is at a point equidistant between the mouth of Barnards Creek and the southern end of the dredge spoil island immediately east of the outfall.
3. The monthly average effluent BOD_5 and TSS concentrations shall not exceed 15% of the respective influent value (85% removal).
4. The facility shall monitor TRC when using chlorination for disinfection. The Division shall consider all effluent total residual chlorine values reported below 50 µg/L to be in compliance with the permit. However, the Permittee shall continue to record and submit all values reported by a North Carolina certified laboratory (including field-certified), even if these values fall below 50 µg/L.
5. Total Nitrogen = TKN + NO_3-N + NO_2-N, where TKN is Total Kjeldahl Nitrogen, NO_3-N is Nitrate Nitrogen, and NO_2-N is Nitrite Nitrogen.
6. Whole Effluent Toxicity shall be monitored using the Pass/Fail Chronic Toxicity test with *Ceriodaphnia dubia* at 4.5% effluent. Samples shall be taken in *March, June, September* and *December*; see Special Condition A. (5.).
7. The Permittee shall perform three Effluent Pollutant Scans during the term of this permit; see Special Condition A. (6.).
8. Instream monitoring for all parameters is provisionally waived considering the Permittee's participation in the Lower Cape Fear River Program. Instream monitoring shall be immediately reinstated, and the Division shall be notified immediately should the Permittee end its participation in the Program.
9. Stream samples shall be collected 3/week from June 1 through September 30, and collected weekly from October 1 through May 31.

b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

A. (3.) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (20.0 MGD) [15A NCAC 02B .0400 et seq., 02B .0500 et seq.] **Grade IV Biological Water Pollution Control System** [15A NCAC 08G .0302]

a. Beginning upon receipt of the Engineer's Certification of completion of the 20.0 MGD expansion and lasting until **expansion above 20.0 MGD (and receipt of the Engineer's Certification of completion)** or permit expiration, the Permittee is authorized to discharge **treated wastewater** from **Outfall 001**. Such discharges shall be limited and monitored [1] by the Permittee as specified below:

EFFLUENT CHARACTERISTICS		LIMITS			MONITORING REQUIREMENTS		
	Parameter Code	**Monthly Average**	**Weekly Average**	**Daily Maximum**	**Measurement Frequency**	**Sample Type**	**Sample Location [2]**
Flow	*50050*	20.0 MGD			Continuous	Recording	Influent or Effluent
BOD, 5-day, 20ºC (Apr 1 – Oct 31) [3]	*CO310*	5.0 mg/L	7.5 mg/L		Daily	Composite	Influent and Effluent
BOD, 5-day, 20ºC (Nov 1 – Mar 31) [3]	*CO310*	10.0 mg/L	15.0 mg/L		Daily	Composite	Influent and Effluent
Total Suspended Solids (TSS) [3]	*CO530*	10.0 mg/L	15.0 mg/L		Daily	Composite	Influent and Effluent
NH_3–N (Apr 1 – Oct 31)	*CO610*	1.0 mg/L	3.0 mg/L		3/Week	Composite	Effluent
NH_3–N (Nov 1 – Mar 31)	*CO610*	2.0 mg/L	6.0 mg/L		3/Week	Composite	Effluent
Enterococci (geometric mean)	*61211*	35/100 mL	276/100 mL		Daily	Grab	Effluent
Total Residual Chlorine (TRC) [4]	*50060*			13.0 µg/L	Daily	Grab	Effluent
Temperature (ºC)	*00010*	Monitor and Report			Daily	Grab	Effluent
pH	*00400*	Between 6.8 and 8.5 Standard Units			Daily	Grab	Effluent
Dissolved Oxygen (DO)	*00300*	Daily average ≥ 6.0 mg/L			Daily	Grab	Effluent
Conductivity (µmhos/cm) [8]	*00094*	Monitor and Report			Daily	Grab	Effluent
Total Nitrogen (mg/L) [5]	*CO600*	Monitor and Report			Monthly	Composite	Effluent
Total Phosphorus (mg/L)	*CO665*	Monitor and Report			Monthly	Composite	Effluent
Bis(2-Ethylhexyl) Phthalate (µg/L)	*39100*	Monitor and Report			Quarterly	Grab	Effluent
Chronic Toxicity [6]	*00300*	*Ceriodaphnia dubia* Pass/Fail at 5.1% effluent			Quarterly	Composite	Effluent
Effluent Pollutant Scan	*00010*	Monitor and Report			Footnote 7	Footnote 7	Effluent
Dissolved Oxygen (DO) (mg/L) [8]	*00094*	Monitor and Report			Variable [9]	Grab	Upstream, Downstream
Temperature (ºC) [8]	*50050*	Monitor and Report			Variable [9]	Grab	Upstream, Downstream
Conductivity (µmhos/cm) [8]	*00094*	Monitor and Report			Variable [9]	Grab	Upstream, Downstream

Footnotes on next page.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

Footnotes:

1. Submit discharge monitoring reports electronically using NC DWR's eDMR application system; see Special Condition A. (10.).
2. Upstream is at a point equidistant between the radio tower north of the WWTP and the northern end of the dredge spoil island immediately east of the outfall. Downstream is at a point equidistant between the mouth of Barnards Creek and the southern end of the dredge spoil island immediately east of the outfall.
3. The monthly average effluent BOD_5 and TSS concentrations shall not exceed 15% of the respective influent value (85% removal).
4. The facility shall monitor TRC when using chlorination for disinfection. The Division shall consider all effluent total residual chlorine values reported below 50 µg/L to be in compliance with the permit. However, the Permittee shall continue to record and submit all values reported by a North Carolina certified laboratory (including field-certified), even if these values fall below 50 µg/L.
5. Total Nitrogen = TKN + NO_3-N + NO_2-N, where TKN is Total Kjeldahl Nitrogen, NO_3-N is Nitrate Nitrogen, and NO_2-N is Nitrite Nitrogen.
6. Whole Effluent Toxicity will be monitored using the Pass/Fail Chronic Toxicity test with *Ceriodaphnia dubia* at 5.1% effluent. Samples shall be taken in *March, June, September* and *December*; see Special Condition A. (5.).
7. The Permittee shall perform three Effluent Pollutant Scans during the term of this permit; see Special Condition A. (6.).
8. Instream monitoring for all parameters is provisionally waived considering the Permittee's participation in the Lower Cape Fear River Program. Instream monitoring shall be immediately reinstated, and the Division shall be notified immediately should the Permittee end its participation in the Program.
9. Stream samples shall be collected 3/week from June 1 through September 30, and collected weekly from October 1 through May 31.

b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

A. (4.) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (24.0 MGD) [15A NCAC 02B .0400 et seq., 02B .0500 et seq.] **Grade IV Biological Water Pollution Control System** [15A NCAC 08G .0302]

a. Beginning upon receipt of the Engineer's Certification of completion of the 24.0 MGD expansion and lasting until or permit expiration, the Permittee is authorized to discharge **treated wastewater** from **Outfall 001**. Such discharges shall be limited and monitored [1] by the Permittee as specified below:

EFFLUENT CHARACTERISTICS		LIMITS			MONITORING REQUIREMENTS		
	Parameter Code	Monthly Average	Weekly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location [2]
Flow	*50050*	24.0 MGD			Continuous	Recording	Influent or Effluent
BOD, 5-day, 20ºC (Summer: April 1 through October 31) [3]	*CO310*	5.0 mg/L	7.5 mg/L		Daily	Composite	Influent and Effluent
BOD, 5-day, 20ºC (Winter: November 1 through March 31) [3]	*CO310*	10.0 mg/L	15.0 mg/L		Daily	Composite	Influent and Effluent
Total Suspended Solids (TSS) [3]	*CO530*	10.0 mg/L	15.0 mg/L		Daily	Composite	Influent and Effluent
NH_3–N (Summer: April 1 through October 31)	*CO610*	1.0 mg/L	3.0 mg/L		3/Week	Composite	Effluent
NH_3–N (Winter: November 1 through March 31)	*CO610*	2.0 mg/L	6.0 mg/L		3/Week	Composite	Effluent
Enterococci (geometric mean)	*61211*	35/100 mL	276/100 mL		Daily	Grab	Effluent
Total Residual Chlorine (TRC) [4]	*50060*			13.0 µg/L	Daily	Grab	Effluent
Temperature (ºC)	*00010*	Monitor and Report			Daily	Grab	Effluent
pH	*00400*	Between 6.8 and 8.5 Standard Units			Daily	Grab	Effluent
Dissolved Oxygen (DO)	*00300*	Daily average ≥ 6.0 mg/L			Daily	Grab	Effluent
Conductivity (µmhos/cm)	*00094*	Monitor and Report			Daily	Grab	Effluent
Total Nitrogen (mg/L) [5]	*CO600*	Monitor and Report			Monthly	Composite	Effluent
Total Phosphorus (mg/L)	*CO665*	Monitor and Report			Monthly	Composite	Effluent
Bis(2-Ethylhexyl) Phthalate (µg/L)	*CO100*	Monitor and Report			Quarterly	Grab	Effluent
Chronic Toxicity [6]	*00300*	*Ceriodaphnia dubia* Pass/Fail at 5.7% effluent			Quarterly	Composite	Effluent
Effluent Pollutant Scan	*00010*	Monitor and Report			Footnote 7	Footnote 7	Effluent
Dissolved Oxygen (DO) (mg/L) [8]	*00094*	Monitor and Report			Variable [9]	Grab	Upstream, Downstream
Temperature (ºC) [8]	*50050*	Monitor and Report			Variable [9]	Grab	Upstream, Downstream
Conductivity (µmhos/cm) [8]	*00094*	Monitor and Report			Variable [9]	Grab	Upstream, Downstream

Footnotes on next page.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

Footnotes:

1. Submit discharge monitoring reports electronically using NC DWR's eDMR application system; see Special Condition A. (10.).
2. Upstream is at a point equidistant between the radio tower north of the WWTP and the northern end of the dredge spoil island immediately east of the outfall. Downstream is at a point equidistant between the mouth of Barnards Creek and the southern end of the dredge spoil island immediately east of the outfall.
3. The monthly average effluent BOD_5 and Total Suspended Solids concentrations shall not exceed 15% of the respective influent value (85% removal).
4. The facility shall monitor TRC when using chlorination for disinfection. The Division shall consider all effluent total residual chlorine values reported below 50 µg/L to be in compliance with the permit. However, the Permittee shall continue to record and submit all values reported by a North Carolina certified laboratory (including field-certified), even if these values fall below 50 µg/L.
5. Total Nitrogen = TKN + NO_3-N + NO_2-N, where TKN is Total Kjeldahl Nitrogen, NO_3-N is Nitrate Nitrogen, and NO_2-N is Nitrite Nitrogen.
6. Whole Effluent Toxicity shall be monitored using the Pass/Fail Chronic Toxicity test with *Ceriodaphnia dubia* at 5.7% effluent. Samples shall be taken in *March, June, September* and *Decembe*r; see Special Condition A. (5.).
7. The Permittee shall perform three Effluent Pollutant Scans during the term of this permit; see Special Condition A. (6.).
8. Instream monitoring for all parameters is provisionally waived considering the Permittee's participation in the Lower Cape Fear River Program. Instream monitoring shall be immediately reinstated, and the Division shall be notified immediately should the Permittee end its participation in the Program.
9. Stream samples shall be collected 3/week from June 1 through September 30, and collected weekly from October 1 through May 31.

b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

A. (5.) CHRONIC TOXICITY PERMIT LIMIT (Quarterly) [15A NCAC 02B .0200 et seq.]

The effluent discharge shall at no time exhibit observable inhibition of reproduction or significant mortality to ***Ceriodaphnia dubia*** at an effluent concentration of **3.8% at 12 MGD; 4.5% at 16 MGD; 5.1% at 20 MGD; and 5.7% at 24 MGD.**

The permit holder shall perform at a minimum, *quarterly* monitoring using test procedures outlined in the "North Carolina *Ceriodaphnia* Chronic Effluent Bioassay Procedure," Revised December 2010, or subsequent versions or "North Carolina Phase II Chronic Whole Effluent Toxicity Test Procedure" (Revised- December 2010) or subsequent versions. The tests will be performed **during the months of *March, June, September* and *December*.** These months signify the first month of each three-month toxicity testing quarter assigned to the facility. Effluent sampling for this testing must be obtained during representative effluent discharge and shall be performed at the NPDES permitted final effluent discharge below all treatment processes.

If the test procedure performed as the first test of any single quarter results in a failure or ChV below the permit limit, then multiple-concentration testing shall be performed at a minimum, in each of the two following months as described in "North Carolina Phase II Chronic Whole Effluent Toxicity Test Procedure" (Revised-December 2010) or subsequent versions.

All toxicity testing results required as part of this permit condition will be entered on the Effluent Discharge Monitoring Form (MR-1) for the months in which tests were performed, using the parameter code **TGP3B** for the pass/fail results and **THP3B** for the Chronic Value. Additionally, DWR Form AT-3 (original) is to be sent to the following address:

Attention: North Carolina Division of Water Resources
Water Sciences Section / Aquatic Toxicology Branch
1621 Mail Service Center
Raleigh, NC 27699-1621

Or, results can be sent to the email, ATForms.ATB@ncdenr.gov.

Completed Aquatic Toxicity Test Forms shall be filed with the Water Sciences Section no later than 30 days after the end of the reporting period for which the report is made.

Test data shall be complete, accurate, include all supporting chemical/physical measurements and all concentration/response data, and be certified by laboratory supervisor and ORC or approved designate signature. Total residual chlorine of the effluent toxicity sample must be measured and reported if chlorine is employed for disinfection of the waste stream.

Should there be no discharge of flow from the facility during a month in which toxicity monitoring is required, the Permittee will complete the information located at the top of the aquatic toxicity (AT) test form indicating the facility name, permit number, pipe number, county, and the month/year of the report with the notation of "No Flow" in the comment area of the form. The report shall be submitted to the Water Sciences Section at the address cited above.

Should the Permittee fail to monitor during a month in which toxicity monitoring is required, monitoring will be required during the following month. Assessment of toxicity compliance is based on the toxicity testing quarter, which is the three-month time interval that begins on the first day of the month in which toxicity testing is required by this permit and continues until the final day of the third month.

Should any test data from this monitoring requirement or tests performed by the North Carolina Division of Water Resources indicate potential impacts to the receiving stream, this permit may be re-opened and modified to include alternate monitoring requirements or limits.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

NOTE: Failure to achieve test conditions as specified in the cited document, such as minimum control organism survival, minimum control organism reproduction, and appropriate environmental controls, shall constitute an **invalid test** and will require immediate follow-up testing to be completed no later than the last day of the month following the month of the initial monitoring.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

A. (6.) EFFLUENT POLLUTANT SCAN AND SECOND SPECIES TOXICITY TESTING (Municipal POTWs) [G.S. 143-215.1(b)]

The Permittee shall perform a total of three (3) Effluent Pollutant Scans for all parameters listed below. One scan must be performed in each of the following years: ***2023*, *2024*, and *2025*.** Analytical methods shall be in accordance with 40 CFR Part 136 and shall be sufficiently sensitive to determine whether parameters are present in concentrations greater than applicable standards and criteria. Samples should be collected with one quarterly toxicity test each year, and must represent seasonal variation [i.e., do not sample in the same quarter every year]. Unless otherwise indicated, metals shall be analyzed as "total recoverable."

Ammonia (as N, NH_3-N)
Chlorine (total residual, TRC)
Dissolved oxygen
Nitrate/Nitrite
Kjeldahl nitrogen
Oil and grease
Phosphorus
Total dissolved solids
Hardness
Antimony
Arsenic
Beryllium
Cadmium
Chromium
Copper
Lead
Mercury (EPA Method 1631E)
Nickel
Selenium
Silver
Thallium
Zinc
Cyanide
Total phenolic compounds

Volatile organic compounds:

Acrolein
Acrylonitrile
Benzene
Bromoform
Carbon tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane
2-chloroethylvinyl ether
Chloroform
Dichlorobromomethane
1,1-dichloroethane
1,2-dichloroethane
Trans-1,2-dichloroethylene
1,1-dichloroethylene
1,2-dichloropropane
1,3-dichloropropylene
Ethylbenzene
Methyl bromide
Methyl chloride
Methylene chloride
1,1,2,2-tetrachloroethane
Tetrachloroethylene
Toluene
1,1,1-trichloroethane
1,1,2-trichloroethane
Trichloroethylene
Vinyl chloride

Acid-extractable compounds:

P-chloro-m-cresol
2-chlorophenol
2,4-dichlorophenol
2,4-dimethylphenol
4,6-dinitro-o-cresol
2,4-dinitrophenol
2-nitrophenol
4-nitrophenol
Pentachlorophenol
Phenol
2,4,6-trichlorophenol

Base-neutral compounds:

Acenaphthene
Acenaphthylene
Anthracene
Benzidine
Benzo(a)anthracene
Benzo(a)pyrene
3,4 benzofluoranthene
Benzo(ghi)perylene
Benzo(k)fluoranthene
Bis (2-chloroethoxy) methane
Bis (2-chloroethyl) ether
Bis (2-chloroisopropyl) ether
Bis (2-ethylhexyl) phthalate
4-bromophenyl phenyl ether
Butyl benzyl phthalate
2-chloronaphthalene
4-chlorophenyl phenyl ether
Chrysene
Di-n-butyl phthalate
Di-n-octyl phthalate
Dibenzo(a,h)anthracene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
3,3-dichlorobenzidine
Diethyl phthalate
Dimethyl phthalate
2,4-dinitrotoluene
2,6-dinitrotoluene
1,2-diphenylhydrazine
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclo-pentadiene
Hexachloroethane
Indeno(1,2,3-cd)pyrene
Isophorone
Naphthalene
Nitrobenzene
N-nitrosodi-n-propylamine
N-nitrosodimethylamine
N-nitrosodiphenylamine
Phenanthrene
Pyrene
1,2,4-trichlorobenzene

Reporting. Test results shall be reported electronically using the Division's eDMR system or on DWR Form DMR-PPA-1 (or on a form approved by the Director) by December 31st of each designated sampling year. The

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

Permittee must at least report completion of the test in the eDMR system by entering "1" of "Y" for parameter code NC01 - Annual Pollutant Scan. If utilizing the DWR Form submit to the following address:

North Carolina Division of Water Resources
NPDES Files
1617 Mail Service Center
Raleigh, North Carolina 27699-1617

Or the form may be uploaded at: https://edocs.deq.nc.gov/Forms/NPDES_WW-EDMR-Supplemental-Form.

Additional Toxicity Testing Requirements for Municipal Permit Renewal. Please note that Municipal facilities that are subject to the Effluent Pollutant Scan requirements listed above are also subject to additional toxicity testing requirements specified in Federal Regulation 40 CFR 122.21(j)(5). The US EPA requires four (4) toxicity tests for a test organism other than the test species currently required in this permit. The second species tests should be conducted either quarterly for a 12-month period prior to submittal of the permit renewal application, or four tests performed at least annually in the four and one-half year (4 ½) period prior to the application. Samples should be collected with one quarterly toxicity test each year, and **must represent seasonal variation [i.e., do not sample in the same quarter every year].** These tests shall be performed for acute or chronic toxicity, whichever is specified in this permit. The multiple species toxicity test results shall be filed with the Aquatic Toxicology Branch at the following address:

North Carolina Division of Water Resources
Water Sciences Section / Aquatic Toxicology Branch
1621 Mail Service Center
Raleigh, North Carolina 27699-1621

Or results can be sent to the email: ATForms.ATB@ncdenr.gov.

Contact the Division's Aquatic Toxicology Branch at 919-743-8401 for guidance on conducting the additional toxicity tests and reporting requirements. Results should also be summarized in Part E (Toxicity Testing Data) of EPA Municipal Application Form 2A, when submitting the permit renewal application to the NPDES Permitting Unit.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

A. (7.) MERCURY MINIMIZATION PLAN (MMP) [G.S. 143-215.1 (b)]

The Permittee shall continue implementing the mercury minimization plan during this permit term. The MMP should place emphasis on identification of mercury contributors and goals for reduction. Results shall be summarized and submitted with the next permit renewal. Performance of the Mercury Minimization Plan will meet the requirements of the TMDL (Total Maximum Daily Load) for mercury approved by USEPA on October 12, 2012, unless and until a Waste Load Allocation specific to this facility is developed and this NPDES permit is amended to require further actions to address the Waste Load Allocation.

A. (8.) HISTORICAL PERMIT LIMITS [G.S. 143-215.1 (b)]

The Division recognizes that prior to issuance of this permit, the M'Kean Maffitt (Southside) WWTP was permitted to discharge with secondary limits of 25.0 mg/L $CBOD_5$, 30.0 mg/L TSS, and no limit for NH_3-N. At the permitted flow of 12.0 MGD, these limits translate approximately to mass loads of 457 tons per year (tpy) BOD_5, 548 tpy TSS, and 365 tpy NH_3-N (assuming 20 mg/L). The mass loads described in this paragraph will be one factor the Division considers when developing future wasteload allocations resulting from the TMDL process or when considering future expansion requests for the M'Kean Maffitt WWTP.

A. (9.) ANTI-BACKSLIDING [G.S. 143-215.1 (b)]

The BOD_5 and NH_3-N limits in this permit may be replaced with less stringent limits without violating state and Federal anti-backsliding provisions if:

1. Material and substantial alterations or additions to the permitted facility occurred after permit issuance that justifies less stringent limits;

2. Events occurred beyond the Permittee's control for which there is no reasonably available remedy;

3. Permittee has properly installed and operated required treatment equipment that cannot achieve permit limits; or

4. New information (other than revised regulations, guidance, or test methods) is available that justifies less stringent limits;

and provided that the Division deems such modification appropriate and consistent with applicable laws and regulations.

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

A. (10.) ELECTRONIC REPORTING OF MONITORING REPORTS [G.S. 143-215.1(b)]

Federal regulations require electronic submittal of all discharge monitoring reports (DMRs) and program reports. The final NPDES Electronic Reporting Rule was adopted and became effective on December 21, 2015.

NOTE: This special condition supplements or supersedes the following sections within Part II of this permit (*Standard Conditions for NPDES Permits*):

- Section B. (11.) Signatory Requirements
- Section D. (2.) Reporting
- Section D. (6.) Records Retention
- Section E. (5.) Monitoring Reports

1. **Reporting Requirements [Supersedes Section D. (2.) and Section E. (5.) (a)]**
The permittee shall report discharge monitoring data electronically using the NC DWR's Electronic Discharge Monitoring Report (eDMR) internet application.

Monitoring results obtained during the previous month(s) shall be summarized for each month and submitted monthly electronically using eDMR. The eDMR system allows permitted facilities to enter monitoring data and submit monthly DMRs electronically using the internet. The eDMR system may be accessed at: https://deq.nc.gov/about/divisions/water-resources/edmr.

If a permittee is unable to use the eDMR system due to a demonstrated hardship or due to the facility being physically located in an area where less than 10 percent of the households have broadband access, then a temporary waiver from the NPDES electronic reporting requirements may be granted and discharge monitoring data may be submitted on paper DMR forms (MR 1, 1.1, 2, 3) or alternative forms approved by the Director. Duplicate signed copies shall be submitted to the following address:

NC Division of Water Resources/Water Quality Permitting Section
ATTENTION: Central Files
1617 Mail Service Center
Raleigh, North Carolina 27699-1617

See "How to Request a Waiver from Electronic Reporting" section below.

Regardless of the submission method, the first DMR is due on the last day of the month following the issuance of the permit or in the case of a new facility, on the last day of the month following the commencement of discharge.

Starting on **December 21, 2025**, the permittee must electronically report the following compliance monitoring data and reports, when applicable:

- Sewer Overflow/Bypass Event Reports;
- Pretreatment Program Annual Reports; and
- Clean Water Act (CWA) Section 316(b) Annual Reports.

The permittee may seek an electronic reporting waiver from the Division (see "How to Request a Waiver from Electronic Reporting" section below).

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

2. **Electronic Submissions**

In accordance with 40 CFR 122.41(l)(9), the permittee must identify the initial recipient at the time of each electronic submission. The permittee should use the EPA's website resources to identify the initial recipient for the electronic submission.

Initial recipient of electronic NPDES information from NPDES-regulated facilities means the entity (EPA or the state authorized by EPA to implement the NPDES program) that is the designated entity for receiving electronic NPDES data [see 40 CFR 127.2(b)].

EPA plans to establish a website that will also link to the appropriate electronic reporting tool for each type of electronic submission and for each state. Instructions on how to access and use the appropriate electronic reporting tool will be available as well. Information on EPA's NPDES Electronic Reporting Rule is found at:

https://www.federalregister.gov/documents/2015/10/22/2015-24954/national-pollutant-discharge-elimination-system-npdes-electronic-reporting-rule

Electronic submissions must start by the dates listed in the "Reporting Requirements" section above.

3. **How to Request a Waiver from Electronic Reporting**

The Permittee may seek a temporary electronic reporting waiver from the Division. To obtain an electronic reporting waiver, a permittee must first submit an electronic reporting waiver request to the Division. Requests for temporary electronic reporting waivers must be submitted in writing to the Division for written approval at least sixty (60) days prior to the date the facility would be required under this permit to begin submitting monitoring data and reports. The duration of a temporary waiver shall not exceed five (5) years and shall thereupon expire. At such time, monitoring data and reports shall be submitted electronically to the Division unless the Permittee re-applies for and is granted a new temporary electronic reporting waiver by the Division. Approved electronic reporting waivers are not transferrable. Only permittees with an approved reporting waiver request may submit monitoring data and reports on paper to the Division for the period that the approved reporting waiver request is effective.

Information on eDMR and the application for a temporary electronic reporting waiver are found on the following web page:

http://deq.nc.gov/about/divisions/water-resources/edmr

4. **Signatory Requirements [Supplements Section B. (11.) (b) and Supersedes Section B. (11.) (d)]**

All eDMRs submitted to the permit issuing authority shall be signed by a person described in Part II, Section B. (11.)(a) or by a duly authorized representative of that person as described in Part II, Section B. (11.)(b). A person, and not a position, must be delegated signatory authority for eDMR reporting purposes.

For eDMR submissions, the person signing and submitting the DMR must obtain an eDMR user account and login credentials to access the eDMR system. For more information on North Carolina's eDMR system, registering for eDMR and obtaining an eDMR user account, please visit the following web page:

http://deq.nc.gov/about/divisions/water-resources/edmr

Certification. Any person submitting an electronic DMR using the state's eDMR system shall make the following certification [40 CFR 122.22]. NO OTHER STATEMENTS OF CERTIFICATION WILL BE ACCEPTED:

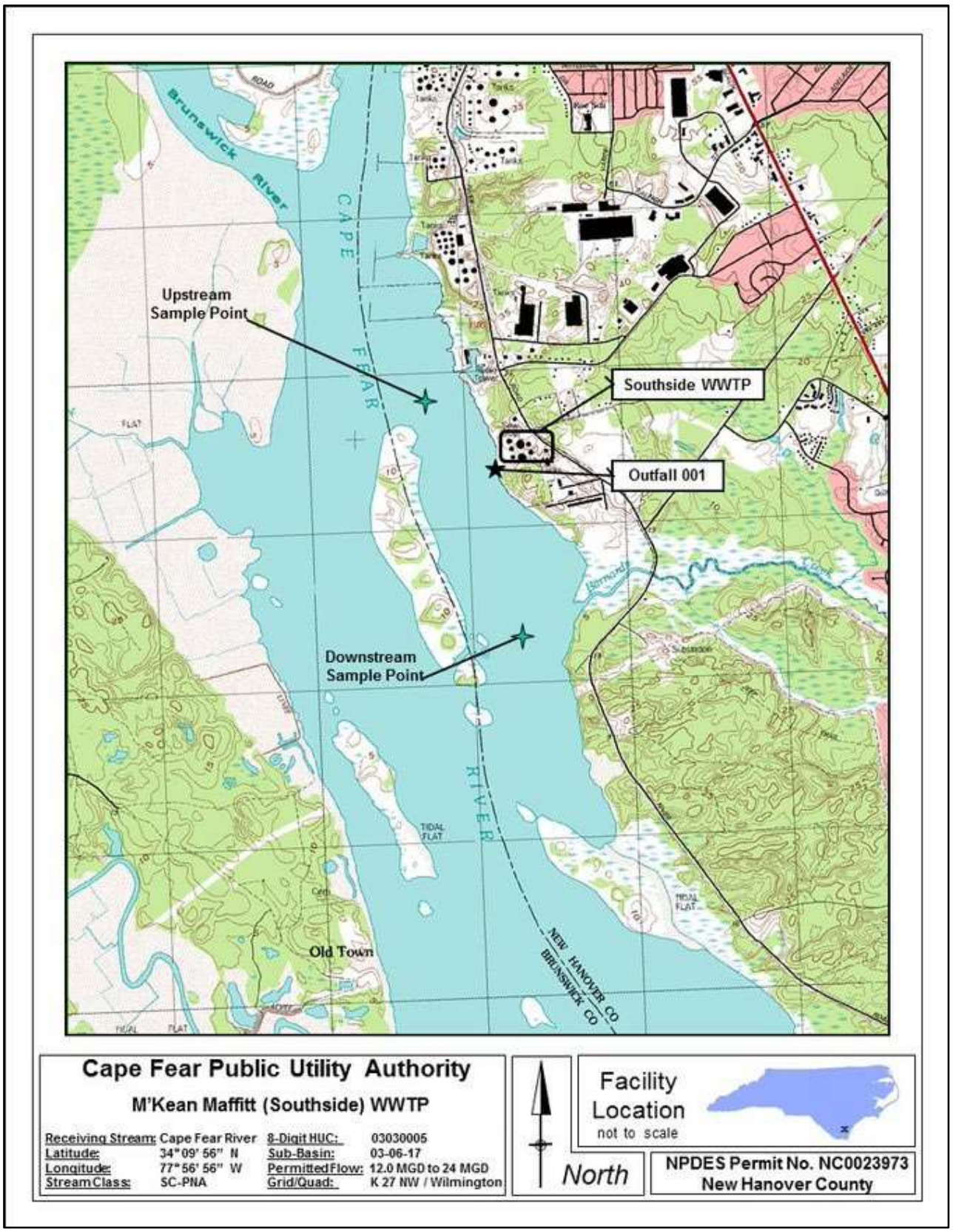
"I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294

evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

5. **Records Retention [Supplements Section D. (6.)]**
The Permittee shall retain records of all Discharge Monitoring Reports, including eDMR submissions. These records or copies shall be maintained for a period of at least three (3) years from the date of the report. This period may be extended by request of the Director at any time [40 CFR 122.41].

DocuSign Envelope ID: FF8B2804-9E98-4172-9647-425AC77EC294



Appendix E

New Hanover County 2022 Census Data

United States Census Bureau

QuickFacts

New Hanover County, North Carolina

QuickFacts provides statistics for all states and counties. Also for cities and towns with a ***population of 5,000 or more***.

All Topics	New Hanover County, North Carolina
Population estimates, July 1, 2023, (V2023)	**238,852**
PEOPLE	
Population	
Population estimates, July 1, 2023, (V2023)	**238,852**
Population Estimates, July 1, 2022, (V2022)	235,784
Population estimates base, April 1, 2020, (V2023)	225,707
Population estimates base, April 1, 2020, (V2022)	225,707
Population, percent change - April 1, 2020 (estimates base) to July 1, 2023, (V2023)	5.8%
Population, percent change - April 1, 2020 (estimates base) to July 1, 2022, (V2022)	4.5%
Population, Census, April 1, 2020	225,702
Population, Census, April 1, 2010	202,667
Age and Sex	
Persons under 5 years, percent	4.5%
Persons under 18 years, percent	17.4%
Persons 65 years and over, percent	19.4%
Female persons, percent	52.2%
Race and Hispanic Origin	
White alone, percent	82.6%
Black or African American alone, percent (a)	12.7%
American Indian and Alaska Native alone, percent (a)	0.6%
Asian alone, percent (a)	1.6%
Native Hawaiian and Other Pacific Islander alone, percent (a)	0.1%
Two or More Races, percent	2.4%
Hispanic or Latino, percent (b)	6.4%
White alone, not Hispanic or Latino, percent	77.4%
Population Characteristics	
Veterans, 2018-2022	14,360
Foreign born persons, percent, 2018-2022	5.3%
Housing	
Housing units, July 1, 2022, (V2022)	120,181
Owner-occupied housing unit rate, 2018-2022	59.5%
Median value of owner-occupied housing units, 2018-2022	$320,000
Median selected monthly owner costs -with a mortgage, 2018-2022	$1,694
Median selected monthly owner costs -without a mortgage, 2018-2022	$601
Median gross rent, 2018-2022	$1,249
Building permits, 2022	3,327
Families & Living Arrangements	
Households, 2018-2022	99,975
Persons per household, 2018-2022	2.21
Living in same house 1 year ago, percent of persons age 1 year+, 2018-2022	83.1%
Language other than English spoken at home, percent of persons age 5 years+, 2018-2022	7.1%
Computer and Internet Use	
Households with a computer, percent, 2018-2022	96.0%
Households with a broadband Internet subscription, percent, 2018-2022	90.9%
Education	
High school graduate or higher, percent of persons age 25 years+, 2018-2022	93.5%
Bachelor's degree or higher, percent of persons age 25 years+, 2018-2022	43.4%
Health	
With a disability, under age 65 years, percent, 2018-2022	8.3%
Persons without health insurance, under age 65 years, percent	11.1%

Economy	
In civilian labor force, total, percent of population age 16 years+, 2018-2022	64.2%
In civilian labor force, female, percent of population age 16 years+, 2018-2022	60.0%
Total accommodation and food services sales, 2017 ($1,000) (c)	856,171
Total health care and social assistance receipts/revenue, 2017 ($1,000) (c)	2,310,492
Total transportation and warehousing receipts/revenue, 2017 ($1,000) (c)	340,356
Total retail sales, 2017 ($1,000) (c)	4,908,803
Total retail sales per capita, 2017 (c)	$21,449
Transportation	
Mean travel time to work (minutes), workers age 16 years+, 2018-2022	20.5
Income & Poverty	
Median household income (in 2022 dollars), 2018-2022	$67,515
Per capita income in past 12 months (in 2022 dollars), 2018-2022	$43,378
Persons in poverty, percent	⚠ 11.7%

BUSINESSES

Businesses	
Total employer establishments, 2021	8,184
Total employment, 2021	106,674
Total annual payroll, 2021 ($1,000)	6,003,017
Total employment, percent change, 2020-2021	1.8%
Total nonemployer establishments, 2021	23,379
All employer firms, Reference year 2017	6,234
Men-owned employer firms, Reference year 2017	3,545
Women-owned employer firms, Reference year 2017	1,144
Minority-owned employer firms, Reference year 2017	314
Nonminority-owned employer firms, Reference year 2017	5,142
Veteran-owned employer firms, Reference year 2017	468
Nonveteran-owned employer firms, Reference year 2017	4,909

GEOGRAPHY

Geography	
Population per square mile, 2020	1,174.0
Population per square mile, 2010	1,058.1
Land area in square miles, 2020	192.26
Land area in square miles, 2010	191.53
FIPS Code	37129

About datasets used in this table

Value Notes

⚠ Methodology differences may exist between data sources, and so estimates from different sources are not comparable.

Some estimates presented here come from sample data, and thus have sampling errors that may render some apparent differences between geographies statistically indistinguishable. Click the Quick Info ⓘ icon to the row in TABLE view to learn about sampling error.

The vintage year (e.g., V2023) refers to the final year of the series (2020 thru 2023). Different vintage years of estimates are not comparable.

Users should exercise caution when comparing 2018-2022 ACS 5-year estimates to other ACS estimates. For more information, please visit the 2022 5-year ACS Comparison Guidance page.

Fact Notes

(a) Includes persons reporting only one race
(c) Economic Census - Puerto Rico data are not comparable to U.S. Economic Census data
(b) Hispanics may be of any race, so also are included in applicable race categories

Value Flags

- Either no or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest or upper in open ended distribution.
F Fewer than 25 firms
D Suppressed to avoid disclosure of confidential information
N Data for this geographic area cannot be displayed because the number of sample cases is too small.
FN Footnote on this item in place of data
X Not applicable
S Suppressed; does not meet publication standards
NA Not available
Z Value greater than zero but less than half unit of measure shown

QuickFacts data are derived from: Population Estimates, American Community Survey, Census of Population and Housing, Current Population Survey, Small Area Health Insurance Estimates, Small Area Income and Pov Estimates, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits.

Appendix F

SSWWTP Flow Data (2020 – 2023)

		Average Flow (MGD)	Max Flow (MGD)	Min Flow (MGD)
2020	1	6.325	6.848	6.000
	2	6.956	8.274	6.101
	3	7.160	8.258	5.556
	4	6.639	7.147	6.273
	5	6.418	8.576	5.627
	6	7.292	10.360	4.939
	7	6.895	7.629	6.354
	8	8.667	12.270	6.879
	9	7.943	10.309	6.743
	10	7.622	8.875	6.989
	11	9.445	11.324	6.893
	12	7.675	8.517	7.213
2021	1	7.701	8.354	6.356
	2	8.802	11.010	7.448
	3	7.791	11.332	6.923
	4	7.236	9.730	6.281
	5	6.446	6.798	5.974
	6	7.469	9.830	6.439
	7	7.072	7.837	6.001
	8	8.539	11.918	6.669
	9	8.378	13.560	6.753
	10	8.031	8.958	7.210
	11	7.224	8.221	6.656
	12	7.010	7.547	6.491
2022	1	7.501	8.139	6.703
	2	7.144	7.442	6.672
	3	7.071	7.607	6.739
	4	7.029	7.850	6.588
	5	6.789	7.447	6.527
	6	7.145	8.326	6.449
	7	7.359	7.724	6.923
	8	7.811	9.989	7.000
	9	7.802	10.431	7.033
	10	8.213	9.289	7.453
	11	8.358	8.915	7.759
	12	8.650	9.128	8.252
2023	1	7.292	9.228	6.306
	2	7.150	9.266	6.691
	3	6.692	7.572	6.334
	4	6.923	7.961	6.532
	5	7.196	9.310	6.499
	6	7.225	8.550	6.797
	7	7.352	7.828	6.860
	8	7.349	11.803	6.630
	9	7.587	9.067	7.004
	10	6.805	7.257	6.470
	11	6.722	7.472	6.410
	12	8.164	12.035	6.574

Appendix G

CFPUA Capital Improvements Plan
(Fiscal Years 2023 – 2032)



Capital Improvements Plan

Fiscal Years 2023—2032

Cape Fear
Public Utility Authority

TABLE OF CONTENTS

Section

Executive Summary

Appendix A. Fiscal Year 2023 Capital Budget

- FY-2023 Project Distribution By Project Type
- FY-2023 Project Distribution By Project Area
- FY-2023 Project Budgets Greater than $1 Million
- Project Drivers and Benefits Matrix
- FY-2023 CIP Budget Priority Sort with Running Cumulative Total
- FY-2023 Individual Project Detailed Information
- FY-2023 Capital Improvements Highest to Lowest Project Budget Sort
- Projected Operating Budget Impacts from FY-2023 CIP

Appendix B. Proposed Ten Year FY-2023 to FY-2032 Capital Improvement Plan

- Ten Year CIP Distribution By Project Type
- Ten Year CIP Distribution By Project Area
- WATER: Projected Ten Year Capital Improvements Plan
- WASTEWATER: Projected Ten Year Capital Improvements Plan
- SYSTEM WIDE: Projected Ten Year Capital Improvements Plan
- Ten Year CIP Highest to Lowest Total Planned Project Cost Sort

Cape Fear
Public Utility Authority
Stewardship. Sustainability. Service.

Executive Summary

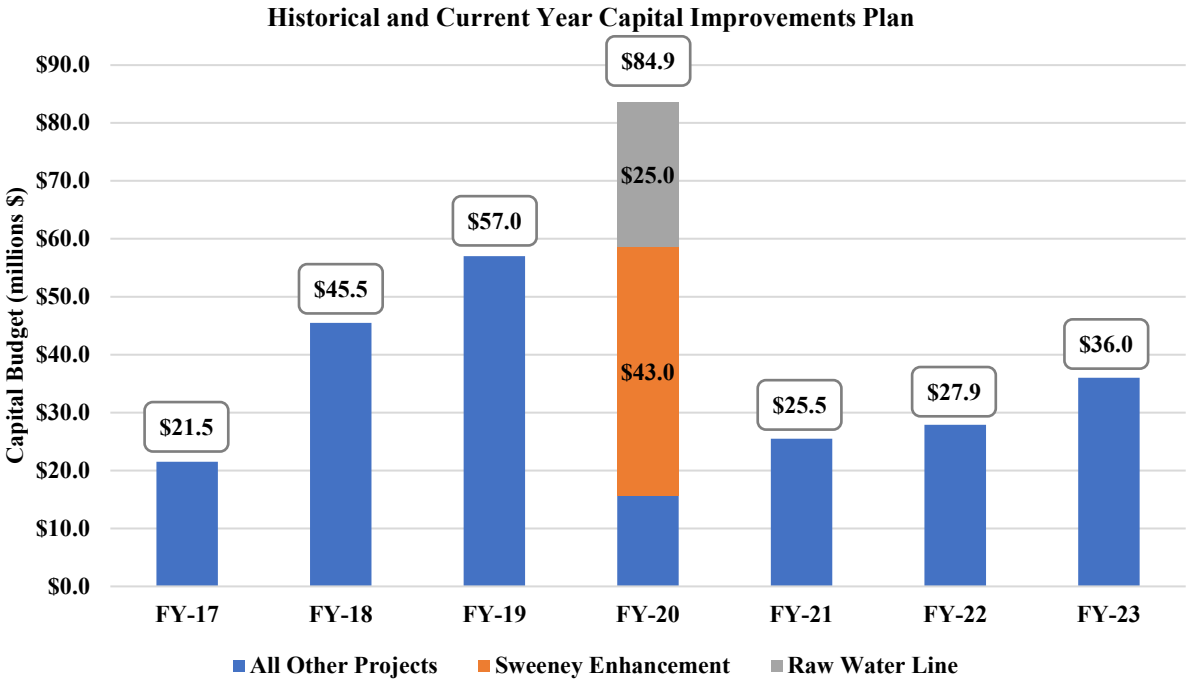
Executive Summary

FY-2023 Capital Improvement Plan

The FY-2023 Capital Budget totals $35.95 million, which is $4 million more than was projected last year. That increase is generally attributable to an increase in material and labor costs throughout the construction industry. For example, PVC pipe, the material used in most of the Authority's linear projects, is affected by 165% year over year price increases due to a shortage in raw materials, the impact of petroleum prices necessary for both manufacture and transportation.

A notable new project beginning in FY-2023 is $1.0 million per year to start a Sustainability Program. These funds can be used to accomplish discrete projects or augment funds for other capital projects to achieve the Authority's sustainability goals.

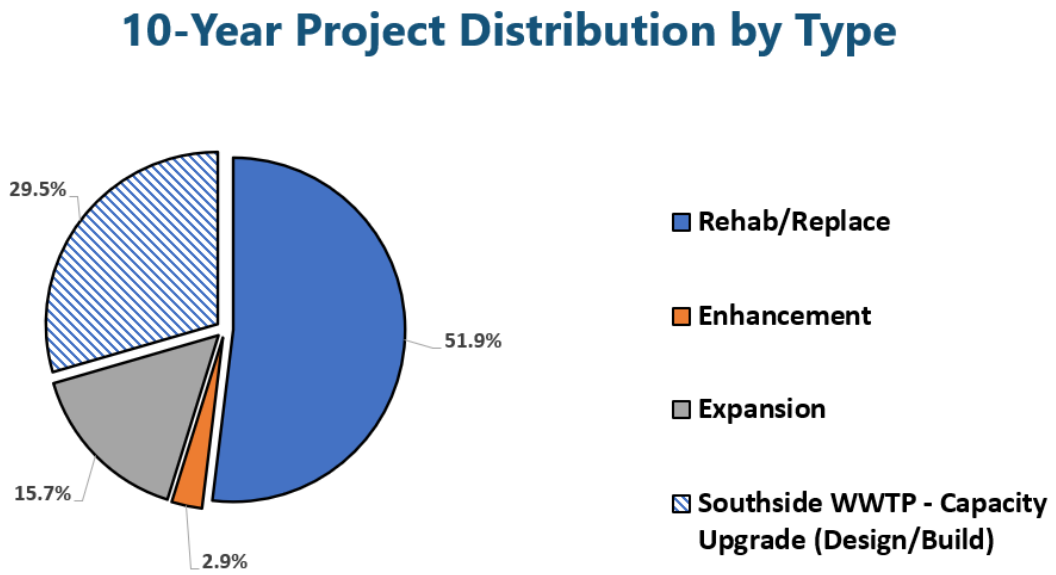
The proposed FY-2023 10-year Capital Improvement Plan (CIP) reflects these same inflationary pressures along with the addition of significant new projects that optimize grant funding opportunities through the American Rescue Plan Act (ARPA). Key ARPA grant funded projects included opportunities to extend water and sewer services into underserved areas currently on well and septic. These project in the Oakley Road and Alandale areas account for approximately $15 million dollars. Project execution is contingent upon award of grant funding.



The largest capital investment in FY-2023 is the $4.2 million in additional funding for the Twin 24 Raw Water Transmission Mains. Previously planned and budgeted in FY-2020, the project consists of a horizontal directional drill of 4,350 linear feet of 36-inch high density polyethylene pipe. The aforementioned inflationary pressures have increased the current construction cost estimate by approximately 50%. Approximately $27 million (76.5%) of work planned for FY-2023 is to rehabilitate or replace aging infrastructure.

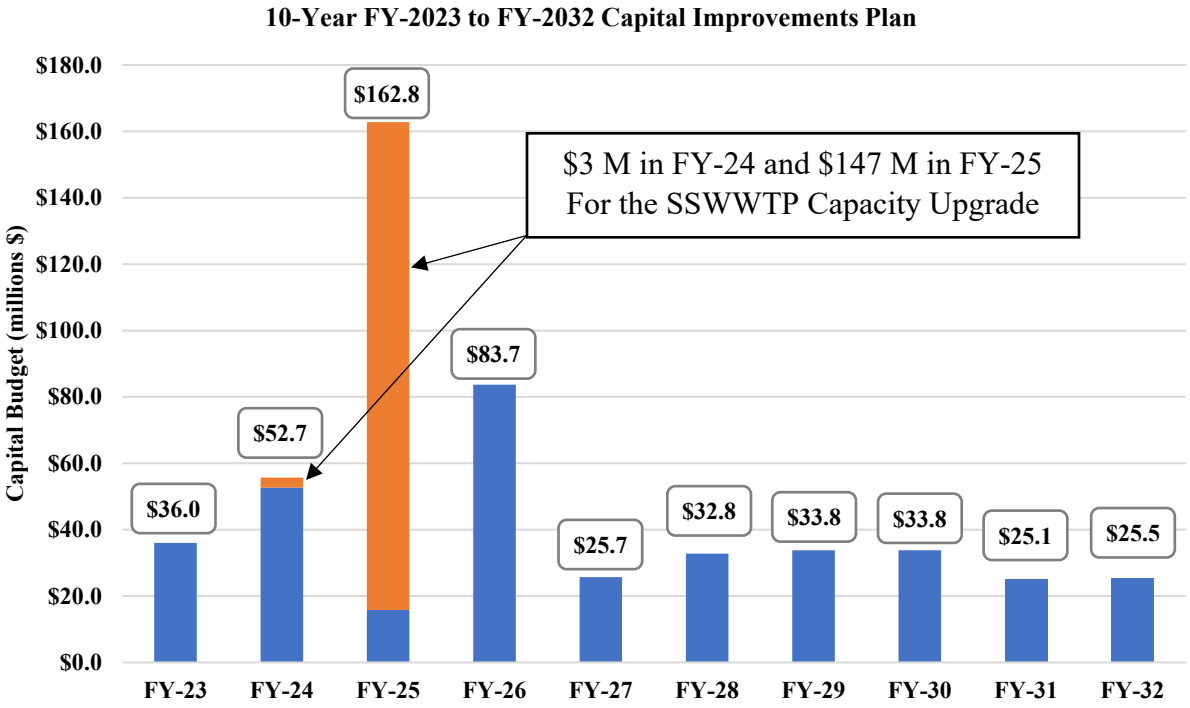
10-Year Capital Improvement Plan

The 10-Year FY-2023 to FY-2032 Capital Improvements Plan (CIP) totals $511.7 million. This is approximately $138 million more than was programmed in the CIP last year. Rehabilitation or Replacement of aging infrastructure represents the 52.2% of the 10-year CIP. The Southside WWTP Upgrade representing 29.3%. Expansion projects that ensure capacity keeps pace with growth and extend utilities to underserved areas represent 15.6% of the total.



The Southside Wastewater Treatment Plant Upgrade construction funding was previously programmed in FY-31 based on historical and projected growth rates informed by the New Hanover County Comprehensive Plan. However, actual and projected growth rates in the northern portion of the County are being accelerated by public/private investment. The Board's decision to fund the $32.8 million Northern Pump Station and Force Mains project with support from a $30 million ARPA earmark in the State Budget will open sewer capacity to over a third of the County. Wastewater treatment capacity to meet the new growth projections will be required by 2030. Advancing the Southside Wastewater Treatment Plant Upgrade construction start to FY25 will accomplish this objective, because approximately 2 million gallons per day of wastewater currently being treated at Northside can be diverted back to Southside by 2030.

The Southside WWTP Upgrade will accommodate redirected flow from Northside by early 2030; provide sufficient capacity for all system growth; avoid financial challenges of back-to-back upgrades at both plants; meet more stringent discharge regulations; and enable more favorable funding opportunities.



The appearance of the Southside Wastewater Treatment Plant Capacity Upgrade construction funding in FY-31 is significant. Based on historical and projected growth rates informed by the New Hanover County Comprehensive Plan, the Southside Wastewater Treatment Plant (WWTP) Capacity Upgrade will be required to be in service by approximately 2030. This applies an annual growth rate of 1.33% throughout the County, which is relatively consistent with observed increases in sewer flows since 2014. This project has an estimated value of $150 million. However, the plant is approaching the end of life of not only the condition of its major infrastructure, but also the performance of its treatment technology. The plant continues to meet all regulatory discharge limits. However, to fulfill the Authority's role in environmental stewardship by reducing discharge limits in the future and reducing ongoing sunk costs to keep the plant operational, funding for the Southside WWTP capacity upgrade project occurs in FY-2025 to complete the construction by FY-2030.

Approximately 49.5% of the $370.1 million investment over the next 10-years will be for the rehabilitation and/or replacement of aging infrastructure.

Capital Improvement Plan - Process and Approach

Overview

The process to develop the annual and 10-year Capital Improvement Plan (CIP) is shown below. It consists of a multi-step process from project identification through the final project prioritization. Every year, the existing CIP and any new project requests are evaluated together through this process to ensure that the recommended plan includes the right projects at the right time.



Project Identification

The first step in the development of the annual and 10-year CIP is the identification of potential projects. Projects can be brought forward by any Department to the CFPUA Capital Committee. The Capital Committee reviews the supporting documentation for all the new projects that have been submitted. Along with reviewing all proposed new projects for the capital program, the Capital Committee also re-evaluates all existing projects in the capital program. The goal is to evaluate and prioritize all projects based on asset management practices, specific drivers and benefits, risk mitigation, and the overall business need for the project. The prioritized list of capital projects must also be consistent with CFPUA's financial goals.

Asset Management

In developing the CIP, CFPUA's strategy is that Asset Management data drives decisions. CFPUA implemented an enterprise-wide asset management program in 2010. The core components of the asset management program are all focused on characterizing the water, wastewater, and support assets in terms of:

- Asset inventory and asset conditions.
- Level of service the assets must provide.
- Criticality and risk of asset failure.
- Life cycle costs of the assets.
- Business case development to support capital improvement decisions.

The first step in CFPUA's Asset Management journey was the development of a Computerized Maintenance Management System (CMMS) to track all assets. To date, approximately 321,000 assets are inventoried in the CMMS and over 1,141,000 work orders have been tracked through completion.

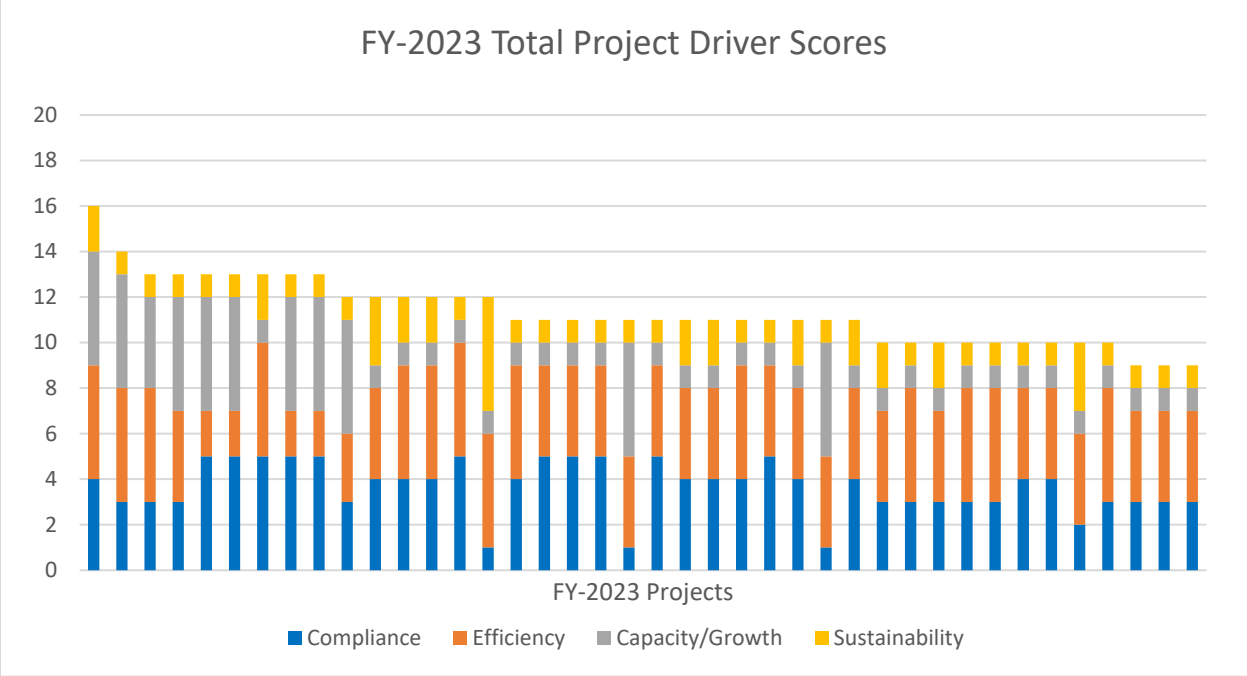
One of the strengths of the CMMS is its ability to track "horizontal" assets with an interface to the CFPUA GIS system. This allows the operational staff to track all aspects of the work that was performed on the assets, including preventive or corrective maintenance, work performed by contractors, and internal and external costs. All asset maintenance data collected supports analysis with respect to the cost to own and operate the asset.

Project Drivers and Benefits

All proposed capital projects are evaluated based on the Drivers and Benefits that are associated with the project. The four standard Drivers and Benefits that must be identified for each proposed project are:

1. **Compliance -** current and future regulatory compliance, including safety and water quality.
2. **Efficiency** - leading to future operating or capital savings, including customer service and financing options.
3. **Capacity/Growth -** additional capacity and/or customers served.
4. **Sustainability -** energy savings, reduced carbon footprint, climate change adaptation.

For each criterion, a project receives a score of 1, 2, 3, 4, or 5. The appendix includes a matrix showing how the score can be establish in a standard approach to all proposed projects.



The graph above shows the FY-2023 projects and their total score for Compliance, Efficiency, Capacity/Growth and Sustainability.

Project Risk Identification

All proposed capital projects are evaluated based on **Risk**, which is defined as the consequence of failure times the likelihood of failure. The risk assessment matrix is shown below.

RISK ASSESSMENT MATRIX

LIKELIHOOD					
5-Very Likely	5	10	15	20	25
4-Likely	4	8	12	16	20
3-Possible	3	6	9	12	15
2-Unlikely	2	4	6	8	10
1-Very Unlikely	1	2	3	4	5
FAILURE	1-Negligible	2-Minor	3-Moderate	4-Significant	5-Severe

CONSEQUENCE

Each proposed capital project receives an asset risk score before the project is implemented (current conditions) and after the proposed project has been implemented. The Project Risk Identification ensures that the highest risk projects are addressed in a timely manner. Also, by comparing the risk before versus the risk after, demonstrates how the capital investment lowers the overall risk to the Authority.

WATER

LIKELIHOOD					
5-Very Likely	5	10	15	20	25
4-Likely	4	8	12	16	20
3-Possible	3	6	9	12	15
2-Unlikely	2	4	6	8	10
1-Very Unlikely	1	2	3	4	5
FAILURE	1-Negligible	2-Minor	3-Moderate	4-Significant	5-Severe

CONSEQUENCE

SEWER

LIKELIHOOD					
5-Very Likely	5	10	15	20	25
4-Likely	4	8	12	16	20
3-Possible	3	6	9	12	15
2-Unlikely	2	4	6	8	10
1-Very Unlikely	1	2	3	4	5
FAILURE	1-Negligible	2-Minor	3-Moderate	4-Significant	5-Severe

CONSEQUENCE

SYSTEMWIDE

LIKELIHOOD					
5-Very Likely	5	10	15	20	25
4-Likely	4	8	12	16	20
3-Possible	3	6	9	12	15
2-Unlikely	2	4	6	8	10
1-Very Unlikely	1	2	3	4	5
FAILURE	1-Negligible	2-Minor	3-Moderate	4-Significant	5-Severe

CONSEQUENCE

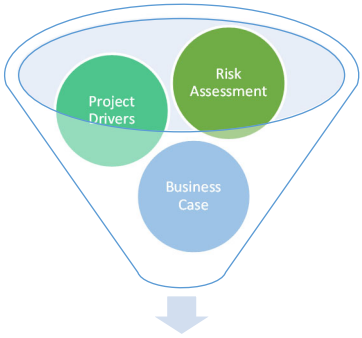
Business Case Evaluation

All projects were evaluated by preparing an initial business case for each project. This process reviews the best information currently available to identify project alternatives, the respective pros and cons for each alternative, and planning level cost comparisons. The risk assessment process previously discussed is incorporated in the Business Case Evaluation with additional information on the risk score. Specifically, how the risk score was determined and whether the risk score was influenced more by the likelihood of failure or the consequence of failure.

Project Prioritization

The final step in CIP development process is taking the information from the previous steps and prioritize the proposed projects. The prioritization focusses on the following elements:

- Risk reduction following the implementing of the project,
- Project drivers and benefits, particularly those projects needed for continued regulatory compliance
- Business case evaluation



Project Prioritization

Aging Infrastructure

Addressing aging infrastructure through the rehabilitation/replacement of existing assets is a significant component of the CIP. Asset management focuses on prioritizing the timely rehabilitation/replacement of these aging assets, which in turn reduces risk and increases resiliency and reliability. There are currently 1,146 miles of water mains in the system with 135 miles over 70 years old. Similarly, there are 923 miles of gravity sewer mains with 110 miles over 70 years old. An assessment was done of the water and wastewater linear assets and pump stations to identify a reasonable rate of asset rehabilitation/replacement to properly manage aging infrastructure for the long term. The assessment can be summarized as follows:

	Total System	Assets Approaching End of Life*	Rehab/Replace Goal Per year of End of Life Assets
Water Mains (miles)	1,146	135	3.0 to 5.5
Gravity Sewer (miles)	923	110	2.0 to 3.7
Force Mains (miles)	154	14	2.0 to 4.0
Pump Stations	152	11	2

* Water and sewer mains over 70 years old. Force mains and pump stations over 40 years old.

Sustainability and Climate Change

New initiatives regarding sustainability and climate change are now being integrated into the Capital Improvement Plan. For example, the FY-2023 CIP can include the purchase of additional electric vehicles as part of the routine fleet replacement, incorporating future flood levels for pump station projects, the continued installation of LED lighting and work on a business case analysis for recovering excess digestor gas for re-use in a combined heating and power project. Additional initiatives are being evaluated in the ongoing Wastewater Master Plan project.

Fiscal Year 2023 Capital Improvement Plan

Overview

The total investment in the FY-2023 Capital Improvement Plan (CIP) is $35,950,000. The table below summarizes the investment in each of the major project categories. The largest investment of $14.80 million is in the Wastewater Collection and Conveyance category.

Project Category	FY-2023 Investment
Wastewater Collection and Conveyance	$14,800,000
Water Storage and Distribution	$9,100,000
General Operation and Support Systems	$5,000,000
Raw Water Supply and Transmission	$4,950,000
Wastewater Treatment	$2,100,000
Water Treatment and Water Quality	$0
Total	**$35,950,000**

Projects by Type

Projects in the capital improvement plan can be categorized in three different types of projects: (1) rehabilitation and replacement, (2) expansion, or (3) enhancement.

- ***Rehabilitation and replacement projects*** are those projects that address aging infrastructure by pro-actively replacing or rehabilitating assets that are approaching the end of their useful life.
- ***Expansion projects*** are those projects that increase water/wastewater capacity or extend water or sewer lines to increase the service area and facilitate the growth of the customer base.
- ***Enhancement projects*** are those projects that improve efficiency by reducing long term costs or increasing readiness.

The table below shows FY-2023 CIP categorized by project type. The largest portion (76.5%) of the FY-2023 CIP will be invested in the rehabilitation/replacement of aging infrastructure. A total of $27,500,000 is allocated to this category spread out over 25 projects.

Project Type	Percent	FY-2023 Investment	No. of Projects
Rehabilitation/Replacement	76.5%	$27,500,000	25
Expansion	17.5%	$6,300,000	11
Enhancement	6.0%	$2,150,000	4
Total	**100%**	**$35,950,000**	**40**

Projects by Area

Projects in the capital improvement plan can also be categorized by the area where the capital investment is made. The five major areas are: (1) water treatment, (2) water distribution, (3) wastewater collection, (4) wastewater treatment, and (5) other.

- ***Water Treatment projects*** includes all assets from the water source through the water treatment process. This includes the Kings Bluff intake and pump station, raw water transmission mains, the Sweeney Water Treatment Plant, groundwater wells, and the Richardson Water Treatment Plant.
- ***Water Distribution projects*** includes all assets needed to convey the treated water from the water treatment plants to the customer, including all water mains, fire hydrants, valving, water storage facilities, and metering.
- ***Wastewater Collection projects*** includes all assets that convey the wastewater from the customer to the wastewater treatment plants. This includes gravity sewer, manholes, pump stations, and force mains.
- ***Wastewater Treatment projects*** includes all assets related to the Northside and Southside Wastewater Treatment Plants.
- ***"Other"*** includes support systems and programs such as IT systems, Fleet, HVAC systems, SCADA, etc.

The table below shows FY-2023 CIP categorized by Project Area.

Project Area	Percent	FY-2023 Investment	No. of Projects
Wastewater Collection	41.2%	$14,800,000	12
Water Distribution	25.3%	$9,100,000	15
Water Treatment	13.9%	$5,000,000	7
Other	13.8%	$4,950,000	3
Wastewater Treatment	5.8%	$2,100,000	3
Total	**100%**	**$35,950,000**	**40**

Top Projects by Value

The table below shows the top projects by their investment value in the FY-2023 CIP. These top 10 projects total $20,750,000, or about 57.7% of the total investment in the FY-2023 CIP.

Project Reference #	Project	FY-2023 Investment
143	PS-9 Walnut Street Pump Station Replacement	$4,500,000
96	Twin 24 Raw Water Transmission Mains	$4,200,000
27	Water Main, Services and Valve Rehab/Replace (AMP)	$2,300,000
154	Southern NHC Regional Pump Station	$1,850,000
162	Chestnut and Grace Water Rehabilitation	$1,500,000
171	Chestnut and Grace Sewer Rehabilitation	$1,500,000
145	PS-14 Greenfield Lake FM Rehab/Replace	$1,300,000
131	Southside WWTP - Interim Rehabilitation Phase II	$1,200,000
175	PS-35 Force Main Redirect and Junction Box Rehabilitation	$1,200,000
34	Motor Fleet Capital	$1,200,000
	Total	**$20,750,000**

Expansion and Growth Projects

The table below shows the expansion and growth projects in the FY-2023 CIP. Expansion and growth projects are those projects that increase water/wastewater capacity or extend water or sewer lines to increase the service area and facilitate the growth of the customer base.

The total investment in expansion and growth projects in FY-2023 is $6,300,000. This represents about 17.8% of the total FY-2023 CIP.

Project Reference #	Project	FY-2023 Investment
154	Southern NHC Regional Pump Station	$1,850,000
163	River Road Booster Pump Station and Interconnections	$1,000,000
165	Gordon Road Interconnection with NCDOT	$1,000,000
178	Oakley Area Septic to Sewer Grant Application	$1,000,000
153	Water System Master Plan	$300,000
179	Alandale Area Sewer Grant Application	$300,000
155	South Castle Hayne Road Water Main	$250,000
167	Oakley Area Water Grant Application	$200,000
39	Distribution System - Standard Developer Agreements	$150,000
38	Collection System - Standard Developer Agreements	$150,000
168	Alandale Area Water Grant Application	$100,000
	Total	**$6,300,000**

It is noteworthy that this plan includes significant investment in southern New Hanover County to accommodate growth and higher density development patterns than projected when wastewater infrastructure was originally installed in that area decades ago.

FY-2023 Project Categories

The following tables show the FY-2023 CIP broken down by each of the six major categories of (1) raw water supply and transmission, (2) water treatment and water quality, (3) water storage and distribution, (4) wastewater collection and conveyance, (5) wastewater treatment, and (6) general operation and support systems.

FY-2023 Raw Water Supply and Transmission Investment

Project Description	Type	FY 2023	Future Funding
Groundwater Well Rehabilitation (AMP)	Rehab/Replace	$600,000	$2,000,000
Kings Bluff Intake Canal Dredging and Rehabilitation	Rehab/Replace	$150,000	$700,000
Twin 24 Raw Water Transmisson Mains	Rehab/Replace	4,200,000	$0
Total		**$4,950,000**	**$2,700,000**

FY-2023 Water Storage and Distribution Investment

Project Description	Type	FY 2023	Future Funding
Porter's Neck Booster Pump Station Rehabilitation	Rehab/Replace	$200,000	$1,000,000
Elevated Tank SCADA Standardization Upgrades	Enhancement	$500,000	$0
Elevated Tank Rehabilitation and Coatings	Rehab/Replace	$850,000	$5,450,000
Chestnut and Grace Water Rehabilitation	Rehab/Replace	$1,500,000	$0
Large Meter Replacement Program	Rehab/Replace	$200,000	$1,800,000
Large Water Meter Vault Replacement	Rehab/Replace	$300,000	$2,700,000
Water Main, Services and Valve Rehab/Replace (AMP)	Rehab/Replace	$2,300,000	$54,600,000
Water Emergency Repair	Rehab/Replace	$250,000	$2,250,000
Water System Master Plan	Expansion	$300,000	$300,000
River Road Booster Pump Station and Interconnections	Expansion	$1,000,000	$9,000,000
South Castle Hayne Road Water Main	Expansion	$250,000	$2,250,000
Distribution System - Standard Developer Agreements	Expansion	$150,000	$1,350,000
Gordon Road Interconnection with NCDOT	Expansion	$1,000,000	$0
Oakley Area Water Grant Application	Expansion	$200,000	$1,800,000
Alandale Area Water Grant Application	Expansion	$100,000	$900,000
Total		**$9,100,000**	**$83,400,000**

FY-2023 Wastewater Collection and Conveyance Investment

Project Description	Type	FY 2023	Future Funding
Find It, Fix It Methodology Sewer Collection Rehabilitation (AMP)	Rehab/Replace	$1,000,000	$37,000,000
Chestnut and Grace Sewer Rehabilitation	Rehab/Replace	$1,500,000	$0
Sewer Emergency Repair	Rehab/Replace	$500,000	$4,500,000
Southern NHC Regional Pump Station	Expansion	$1,850,000	$0
Pump Stations Prioritization and Rehabilitation	Rehab/Replace	$1,000,000	$9,000,000
PS-9 Walnut Street Pump Station Replacement	Rehab/Replace	$4,500,000	$0
PS-14 Greenfield Lake FM Rehab/Replace	Rehab/Replace	$1,300,000	$0
PS-35 Force Main Redirect and Junction Box Rehabilitation	Rehab/Replace	$1,200,000	$0
Wet Weather Model Development	Enhancement	$500,000	$0
Oakley Area Septic to Sewer Grant Application	Expansion	$1,000,000	$9,000,000
Alandale Area Sewer Grant Application	Expansion	$300,000	$1,700,000
Collection System - Standard Developer Agreements	Expansion	$150,000	$1,350,000
Total		**$14,800,000**	**$62,550,000**

FY-2023 Wastewater Treatment

Project Description	Type	FY 2023	Future Funding
Southside WWTP - Copper Coagulant Chemical Feed System	Rehab/Replace	$150,000	$950,000
Northside WWTP - Interim Facility Improvements	Rehab/Replace	$750,000	$0
Southside WWTP - Interim Rehabilitation Phase II	Rehab/Replace	$1,200,000	$0
Total		**$2,100,000**	**$950,000**

FY-2023 General Operation and Support Systems Investment

Project Description	Type	FY 2023	Future Funding
Motor Fleet Capital	Rehab/Replace	$1,200,000	$8,100,000
OPS Large Equipment Purchases (Pumps, Plant Equipment, HVAC)	Rehab/Replace	$1,000,000	$9,000,000
IT SCADA & Security	Rehab/Replace	$750,000	$6,750,000
Information Technology Networking Infrastructure Replacement	Rehab/Replace	$150,000	$1,350,000
Generator Rehab and Replacement Program (AMP)	Rehab/Replace	$500,000	$4,500,000
Facilities Structural and Roof Assessment and Rehab/Replace (AMP)	Rehab/Replace	$400,000	$4,200,000
Sustainability Program	Enhancement	$1,000,000	$9,000,000
Total		**$5,000,000**	**$42,900,000**

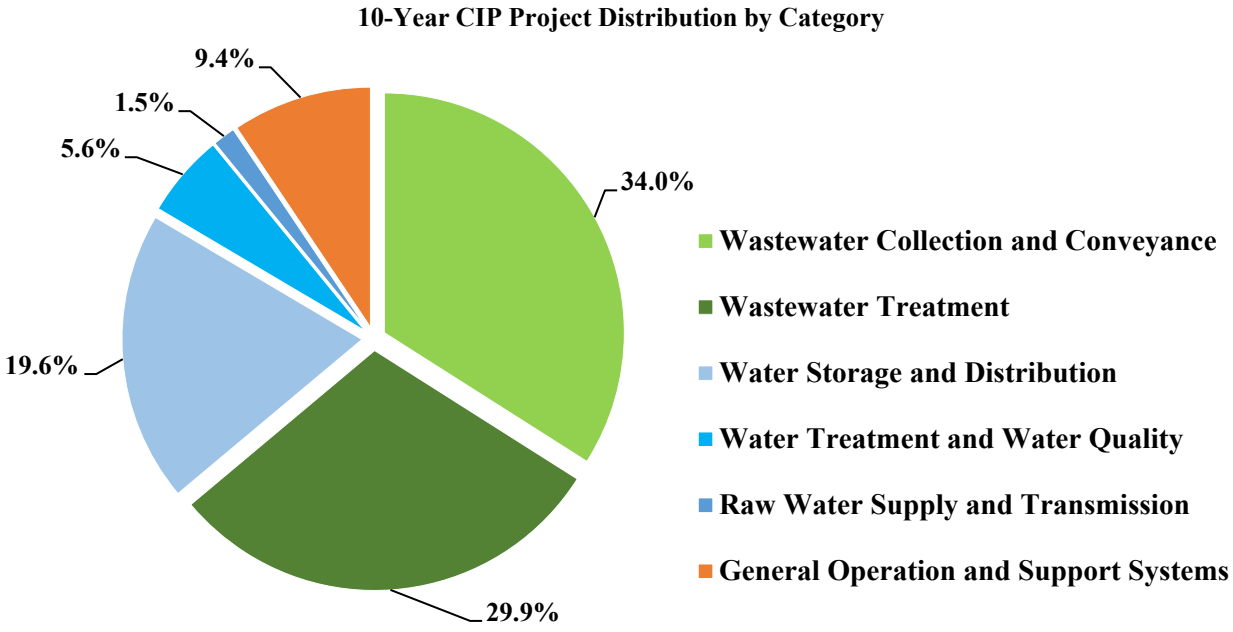
10-Year Capital Improvement Plan

Overview

The total investment in the 10-year CIP from FY-2023 through FY-2032 is $511,700,000. The table below summarizes the investment in each of the major project categories. The largest investment of $173.8 million is in wastewater collection and conveyance.

Project Category	Ten Year Investment
Wastewater Collection and Conveyance	$173,800,000
Wastewater Treatment	$153,050,000
Water Storage and Distribution	$100,300,000
General Operation and Support Systems	$48,300,000
Water Treatment and Water Quality	$28,400,000
Raw Water Supply and Transmission	$7,850,000
Total	**$511,700,000**

The 10-year CIP continues to invest in the wastewater treatment ($153.05 million) and in the water distribution system ($100.3 million). These investments are primarily driven by asset management and the replacement/rehabilitation of aging infrastructure.

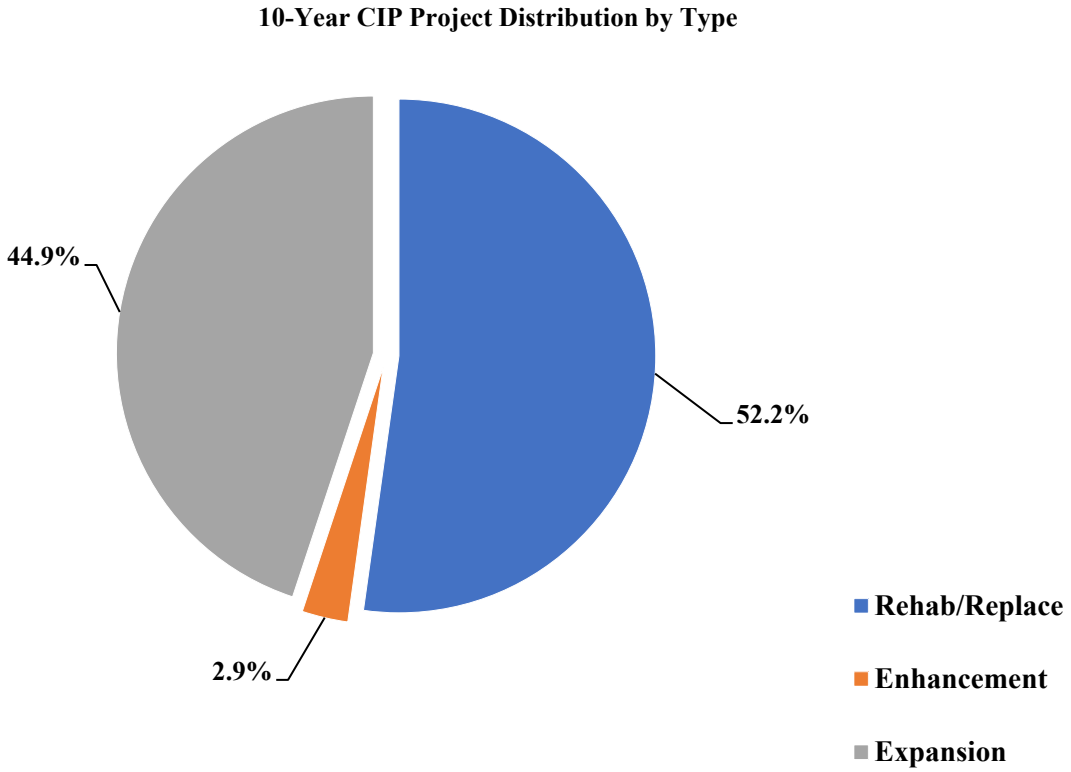


Projects by Type

Projects in the capital improvement plan can be categorized in three different types of projects: (1) rehabilitation and replacement, (2) expansion, or (3) enhancement.

- ***Rehabilitation and replacement projects*** are those projects that address aging infrastructure by pro-actively replacing or rehabilitating assets that are approaching the end of their useful life.
- ***Expansion projects*** are those projects that increase water/wastewater capacity or extend water or sewer lines to increase the service area and facilitate the growth of the customer base.
- ***Enhancement projects*** are those projects that improve efficiency by reducing long term costs or increasing readiness.

The chart below shows 10-Year CIP categorized by project type. The largest portion (52.2%) of the 10-Year CIP will be invested into the rehabilitation and replacement of aging infrastructure. The next largest portion (44.9%) will be invested into expansion. Since the SSWWTP Expansion fully rehabilitates or replaces all elements of the treatment plant, there are significant benefits increasing overall infrastructure life through this project beyond the benefit of expansion benefits.

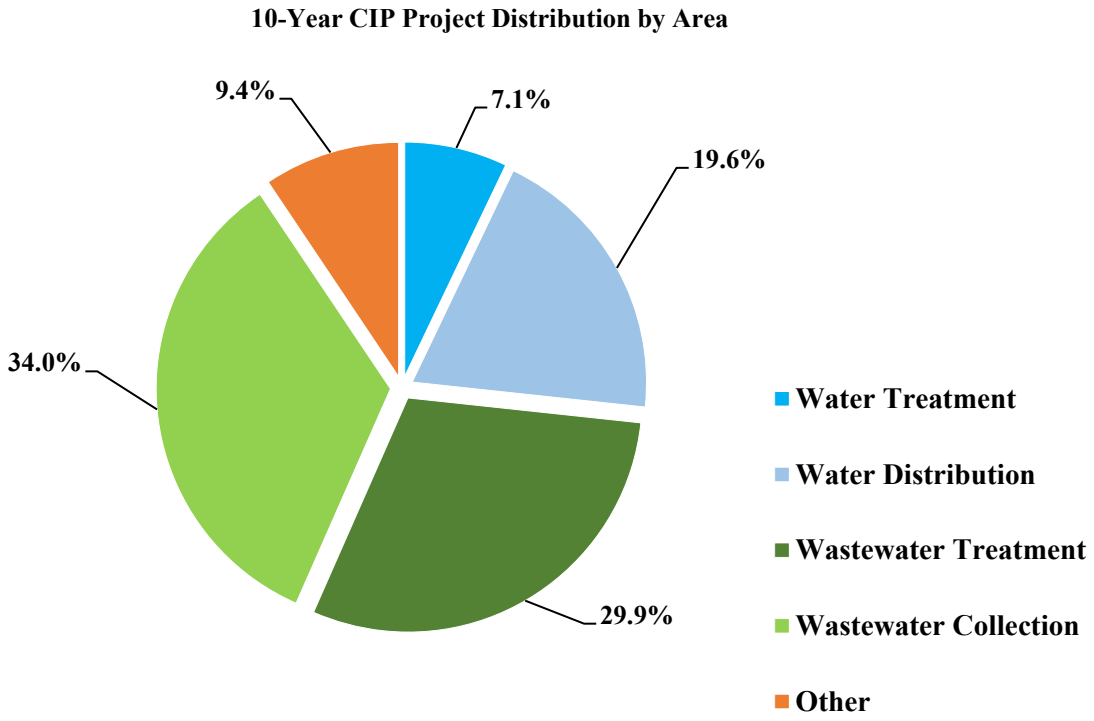


Projects by Area

Projects in the capital improvement plan can also be categorized by the area where the capital investment is made. The five major areas are: (1) water treatment, (2) water distribution, (3) wastewater collection, (4) wastewater treatment, and (5) other.

- ***Water Treatment projects*** includes all assets from the water source through the water treatment process. This includes the Kings Bluff intake and pump station, raw water transmission mains, the Sweeney Water Treatment Plant, groundwater wells, and the Richardson Water Treatment Plant.
- ***Water Distribution projects*** includes all assets needed to convey the treated water from the water treatment plants to the customer, including all water mains, fire hydrants, valving, and water storage facilities.
- ***Wastewater Collection projects*** includes all assets that convey the wastewater from the customer to the wastewater treatment plants. This includes gravity sewer, manholes, pump stations, and force mains.
- ***Wastewater Treatment projects*** includes all assets related to the Northside and Southside Wastewater Treatment Plants.
- ***"Other"*** includes support systems and programs such as IT systems, Fleet, HVAC systems, SCADA, etc.

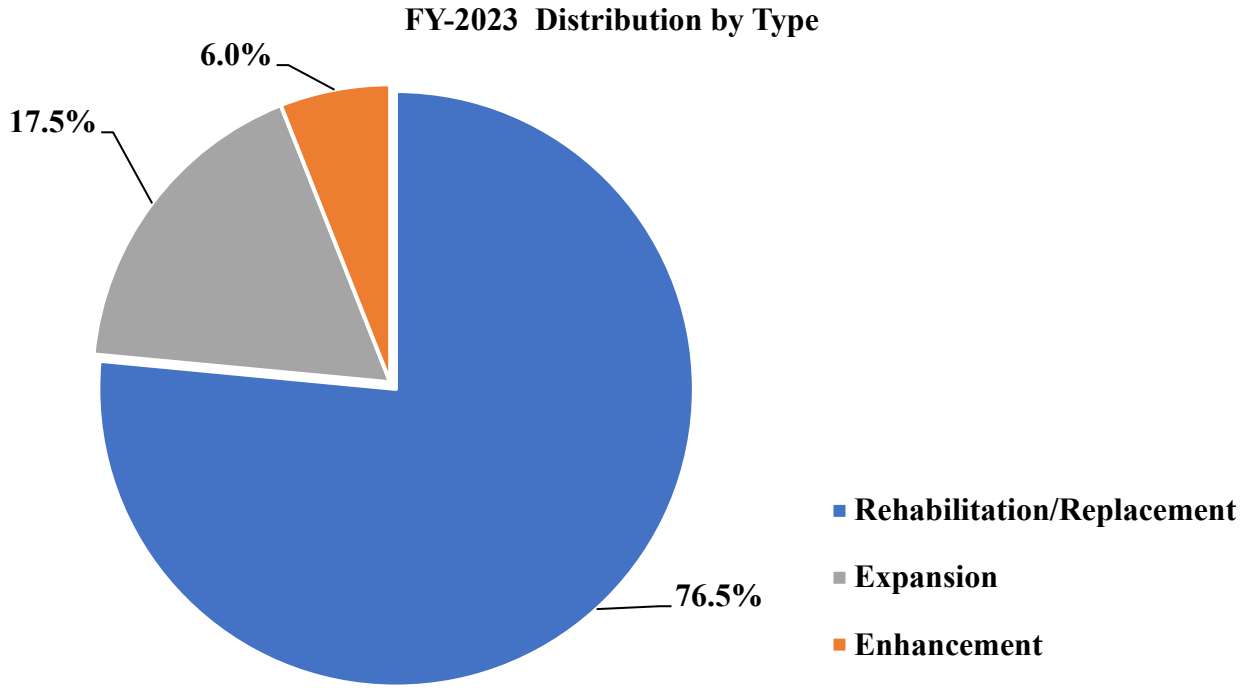
The chart below shows 10-Year CIP categorized by Project Area. The largest portion (34.0%) of the 10-Year CIP will be invested into wastewater treatment followed by the 29.9% invested into the water storage and distribution.



Appendix A
Fiscal Year 2023 Capital Budget

FY-2023 Project Distribution By Project Type

Project Type	Percent	FY-2023 Investment	No. of Projects
Rehabilitation/Replacement	76.5%	$27,500,000	25
Expansion	17.5%	$6,300,000	11
Enhancement	6.0%	$2,150,000	4
Total	**100%**	**$35,950,000**	**40**



Categories:

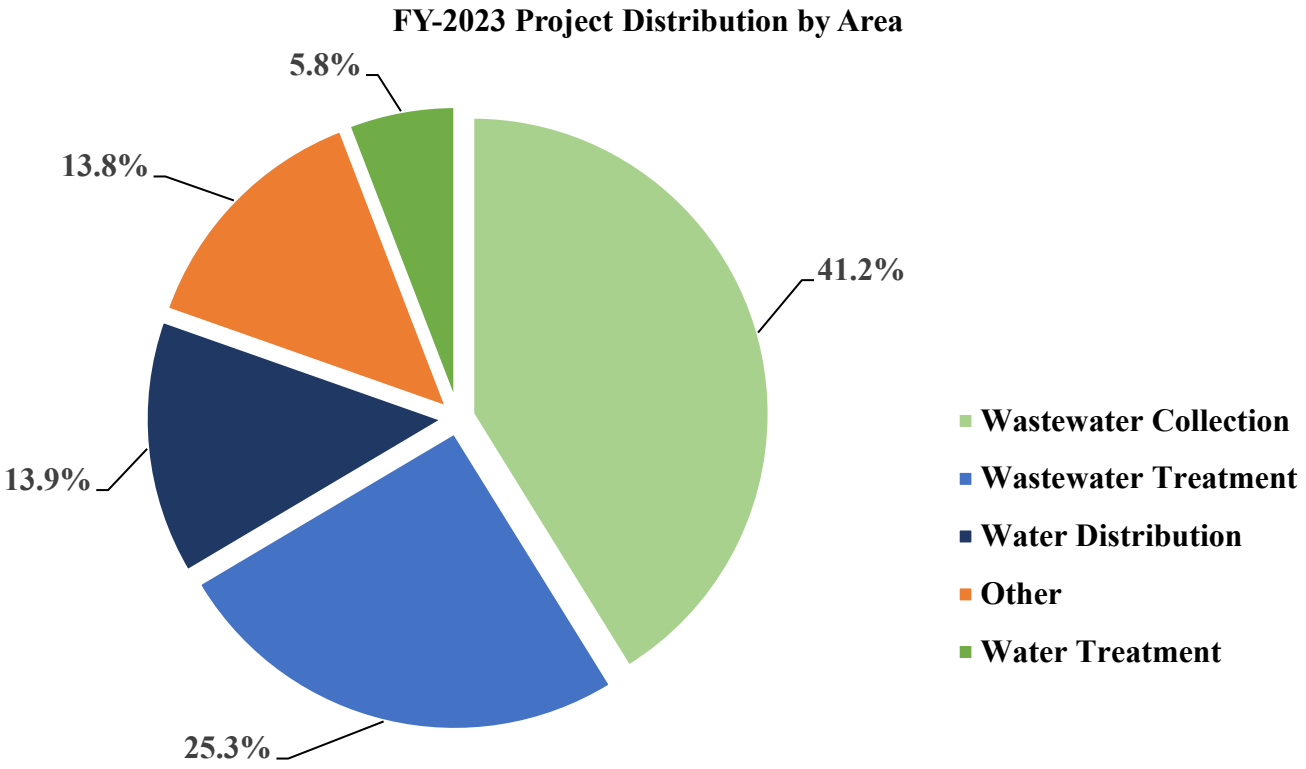
1) Projects that "Rehab or Replace Assets" are the majority of the capital budget in FY-2023. These projects generally increase the life of an existing asset or replace an existing asset which is at or beyond its expected life cycle.

2) "Enhancement" projects tend to improve efficiency by reducing long term costs or increase readiness.

3) "Expansion" projects add customers as growth.

FY-2023 Project Distribution By Project Area

Project Area	Percent	FY-2023 Investment	No. of Projects
Wastewater Collection	41.2%	$14,800,000	12
Wastewater Treatment	25.3%	$9,100,000	15
Water Distribution	13.9%	$5,000,000	7
Other	13.8%	$4,950,000	3
Water Treatment	5.8%	$2,100,000	3
Total	**100%**	**$35,950,000**	**40**



FY-2023 Project budgets Greater than $1 Million

Following are brief descriptions of capital improvement projects with FY 2023 budgets of $1,000,000 and above.
Project reference numbers correspond with the specific project sheets found elsewhere in this document.

Project Ref #	Water Projects	FY-2023 Project Budget	Description
27	Water Main, Services and Valve Rehab/Replace (AMP)	$2,300,000	Areas of our distribution system are beyond their designed life cycle. Utilizing asset management principles, including risk mitigation, and remaining useful life, assets are prioritized to be rehabbed or replaced. The focus during FY-2023 remains on replacing or rehabilitating water distribution mains and valves that are over 70 years old in downtown Wilmington and the surrounding vicinity. Water services are composed of galvanized pipe and lead goosenecks are being inventoried and replaced in these projects. CFPUA has approximately 1,144 miles of water distribution mains. Approximately 165 miles of water mains in the City are over 70 years old.
96	Twin 24 Raw Water Transmisson Mains	$4,200,000	Two aerial 24-inch diameter raw water mains are set on pilings directly in the flow path of the Lower Cape Fear River and Toomers Creek during flood events, such as experienced in September 2018 during Hurricane Florence. In addition, these mains are parallel to active railroad tracks subject to damage in the event of a rail accident. These mains convey 10 million gallons per day (MGD) of CFPUA's raw water supply. These 24-inch cast iron pipes are above grade on wooden pier supports. The north main was installed in the 1920s and the south main was installed in the 1950s. The cast iron pipe itself was deemed to be structurally sound in 2009. However, failing wooden pilings, leaking lead joints and potential exposure to natural and manmade disasters elevate the risk of failure to a critical level. This project will rehabilitate or replace the most vulnerable portion of the infrastructure. The FY-23 funding is in addition to prior year funding.
162	Chestnut and Grace Water Rehabilitation	$1,500,000	Chestnut and Grace Water Rehabilitation is an initiative in cooperation with the City of Wilmington to Rehabilitate or Replace water infrastructure in advance of a significant paving job to improve the road surface by the City. The project will replace all galvanized water service lines in the area, including any lead goosenecks, valves and any mains that do not have extended life into the future. The project area covers the full extent of Chestnut and Grace Streets from the intersection of 3rd Street to the intersection of 17th Street and is associated with a sewer rehab project in the same area.
163	River Road Booster Pump Station and Interconnections	$1,000,000	River Road Booster Pump Station and Interconnections project will enable the existing Monterey Heights Groundwater System to be supplied by Sweeney Water Treatment Plant. This will enable all groundwater wells in New Hanover County to become emergency wells, reducing reliance on aquifers and reducing operating costs to operate and maintain the wells. The project will strengthen interconnectivity at key areas of the Authority's water system, including a booster pump and 16-inch water main extension from RiverLights to Veteran's Park.
165	Gordon Road Interconnection with NCDOT	$1,000,000	Gordon Road Water Mains Interconnection with NCDOT will fund installation of water main interconnections along Gordon Road before NCDOT widens the road, greatly increasing the price of future improvements. Enhanced interconnections now will increase the interconnectivity between the Sweeney supplied system and the Richardson supplied system. This will increase overall system resilience and improve water quality by eliminating dead end mains.

Project Ref #	Wastewater Projects	FY-2023 Project Budget	Description
4	Find It, Fix It Methodology Sewer Collection Rehabilitation (AMP)	$1,000,000	Areas of our collection system are beyond their designed life cycle. Utilizing asset management principles, including risk mitigation, and remaining useful life, assets are prioritized to be rehabbed or replaced. The focus during FY-2023 remains on rehabilitating or replacing gravity sewer mains that are over 70 years old in downtown Wilmington and the surrounding vicinity. CFPUA has approximately 915 miles of gravity sewer. Approximately 110 miles of gravity sewer mains in the City are over 70 years old.
126	Pump Stations Prioritization and Rehabilitation	$1,000,000	CFPUA has 13 sewer pump stations that are known to be past 40 years old and in need of rehabilitation or replacement. Through asset management, staff annually evaluates these pump stations for condition and consequence. Design and construction of replacement or rehabilitation of PS-41 and PS-61 were the investment in FY-2022. Due to increased construction costs and staff developing a more sustainable opportunity to eliminate PS- 61 entirely (pending potential issuance of an NCDEQ variance that would allow construction of gravity sewer at a flatter slope), the FY-2023 investment will be directed towards completing those previously identified pump stations.
131	Southside WWTP - Interim Rehabilitation Phase II	$1,200,000	Mechanical components of the headworks at the Southside Wastewater Treatment Plant have exceeded their lifecycle and rehabilitation needs to be completed to reduce risk and ongoing repair costs. This includes the mechanical bar screen and the grit removal mechanism, and repurposing the former chlorine building to a maintenance facility. The FY-23 funding is in addition to prior year funding.
143	PS-9 Walnut Street Pump Station Replacement	$4,500,000	This Project replaces existing Walnut St Sewer Pump Station (PS-9) which was built in 1970, which is rated at 1.872 MGD with a new sewer pump station rated at 1.613 MGD. Included in the scope of this project is to remove Market St Sewer Pump Station (PS-11), which is part of the existing flow to PS-9 via force main and connect this flow through approximately 1800 feet of 16-inch PVC C905 gravity sewer.
145	PS-14 Greenfield Lake FM Rehab/Replace	$1,300,000	The PS-14 force main is over 45 years old and is one of the highest risk force mains. Concrete pipe material (PCCP) of the force main makes it difficult to do emergency repairs. The FY-23 funding is in addition to prior year funding.
154	Southern NHC Regional Pump Station	$1,850,000	The rate and density of growth in southern New Hanover County will generate more sewer flows than existing infrastructure will be able to convey in the future. Existing infrastructure was planned and sized decades ago before new growth patterns were evident. This project will construct a regional pump station that will redirect wastewater flow away from Motts Creek Gravity Sewer Outfall to provide capacity for future growth in this basin. The FY- 23 funding is in addition to prior year funding.
171	Chestnut and Grace Sewer Rehabilitation	$1,500,000	Chestnut and Grace Sewer Rehabilitation is an initiative in cooperation with the City of Wilmington to Rehabilitate or Replace sewer infrastructure in advance of a significant paving job to improve the road surface by the City. The project will conduct point repairs to damaged pipe in advance of lining and replace any failing manholes or sewer services that cannot be rehabilitated later. The project area covers the full extent of Chestnut and Grace Streets from the intersection of 3rd Street to the intersection of 17th Street and is associated with a water rehab project in the same area.
175	PS-35 Force Main Redirect and Junction Box Rehabilitation	$1,200,000	By redirecting a major force main from a manhole to a large junction box with odor treatment, the PS-35 Force Main Redirect and Junction Box Rehabilitation corrects conditions at the Bradley Creek Pump Station that may be contributing to excess odor at the station and rehabilitates or replaces onsite manholes and mains that are past their lifecycle.
178	Oakley Area Septic to Sewer Grant Application	$1,000,000	Alandale Area Septic to Sewer Service project results from a grant opportunity to provide sewer service to under-served areas that are on individual septic tanks for wastewater treatment. This project and the associated well to water service project are contingent upon receipt of grant funding.

Project Ref #	System Wide Projects	FY-2023 Project Budget	Description
34	Motor Fleet Capital	$1,200,000	CFPUA developed a long-term model for motor fleet replacements based on predetermined criteria. Each of these vehicles will be evaluated based on maintenance records and history. Replacement of those that can be extended in life cost effectively will be deferred. Fleet capital costs are an ongoing major capital expense. By setting aside regular appropriations of capital each year, the Authority is better financially prepared to prevent unplanned funding demands due to motor fleet expenses, without adequate resources. Motor Fleet investments support the Authority's sustainability goals by increasing the population of electric vehicles in the fleet, where operational requirements can be met by these vehicles.
40	OPS Large Equipment Purchases (Pumps, Plant Equipment, HVAC)	$1,000,000	This project funds replacement of large equipment such as HVAC, pumps and other equipment replacements large enough to be a capital project for any facility arising due to unplanned but non-emergency system failures that occur during the year.
182	Sustainability Program	$1,000,000	Sustainability Program Capital Project funding enables Authority investment in capital projects to increase sustainability or resiliency of Authority infrastructure. Improving energy efficiency, decreasing emissions, or reducing net carbon impacts are typical, but not exclusive opportunities. Sustainability program funding may be used to initiate a new project or augment an existing project to enhance the sustainability or resilience of planned infrastructure.

Project Drivers and Benefits Matrix

Benefits and Driver Category	1	2	3	4	5
Compliance	Current and future regulatory compliance, including safety and water quality.	Current and future regulatory compliance, including safety and water quality.	Current and future regulatory compliance, including safety and water quality.	Current and future regulatory compliance, including safety and water quality.	Current and future regulatory compliance, including safety and water quality.
Efficiency	Leading to future operating or capital savings, including customer service and financing options.	Leading to future operating or capital savings, including customer service and financing options.	Leading to future operating or capital savings, including customer service and financing options.	Leading to future operating or capital savings, including customer service and financing options.	Leading to future operating or capital savings, including customer service and financing options.
Capacity/Growth	Additional capacity and/or customers served.	Additional capacity and/or customers served.	Additional capacity and/or customers served.	Additional capacity and/or customers served.	Additional capacity and/or customers served.
Sustainability	Energy savings, reduced carbon footprint, climate change adaptation.	Energy savings, reduced carbon footprint, climate change adaptation.	Energy savings, reduced carbon footprint, climate change adaptation.	Energy savings, reduced carbon footprint, climate change adaptation.	Energy savings, reduced carbon footprint, climate change adaptation.

FY 2023 Capital Improvements Budget Sort with Running Cumulative Total

Reference Number	Running Cumulative FY-23 Total	Project Name	Project Type	Project Area	FY-23 Budget	Project Drivers and Benefits			
163	$1,000,000	River Road Booster Pump Station and Interconnections	Expansion	Water Distribution	$1,000,000	Compliance:	4	16	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
165	$2,000,000	Gordon Road Interconnection with NCDOT	Expansion	Water Distribution	$1,000,000	Compliance:	3	14	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
4	$3,000,000	Find It, Fix It Methodology Sewer Collection Rehabilitation (AMP)	Rehab or Replace Assets	Wastewater Collection	$1,000,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
153	$3,300,000	Water System Master Plan	Expansion	Water Distribution	$300,000	Compliance:	3	13	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	4		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
155	$3,550,000	South Castle Hayne Road Water Main	Expansion	Water Distribution	$250,000	Compliance:	3	13	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
167	$3,750,000	Oakley Area Water Grant Application	Expansion	Water Distribution	$200,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	2		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
168	$3,850,000	Alandale Area Water Grant Application	Expansion	Water Distribution	$100,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	2		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
178	$4,850,000	Oakley Area Septic to Sewer Grant Application	Expansion	Wastewater Collection	$1,000,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	2		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
179	$5,150,000	Alandale Area Sewer Grant Application	Expansion	Wastewater Collection	$300,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	2		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
40	$6,150,000	OPS Large Equipment Purchases (Pumps, Plant Equipment, HVAC)	Rehab or Replace Assets	Other	$1,000,000	Compliance:	4	12	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
114	$6,900,000	IT SCADA & Security	Rehab or Replace Assets	Other	$750,000	Compliance:	5	12	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
126	$7,900,000	Pump Stations Prioritization and Rehabilitation	Rehab or Replace Assets	Wastewater Collection	$1,000,000	Compliance:	4	12	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	3		Energy savings, reduced carbon footprint, climate change adaptation.
154	$9,750,000	Southern NHC Regional Pump Station	Expansion	Wastewater Collection	$1,850,000	Compliance:	3	12	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	3		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
177	$10,250,000	Wet Weather Model Development	Enhancement	Wastewater Collection	$500,000	Compliance:	4	12	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.

Reference Number	Running Cumulative FY-23 Total	Project Name	Project Type	Project Area	FY-23 Budget	Project Drivers and Benefits			
182	$11,250,000	Sustainability Program	Enhancement	Other	$1,000,000	Compliance:	1	12	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	5		Energy savings, reduced carbon footprint, climate change adaptation.
1	$11,750,000	Sewer Emergency Repair	Rehab or Replace Assets	Wastewater Collection	$500,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
27	$14,050,000	Water Main, Services and Valve Rehab/Replace (AMP)	Rehab or Replace Assets	Water Distribution	$2,300,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
38	$14,200,000	Collection System - Standard Developer Agreements	Expansion	Wastewater Collection	$150,000	Compliance:	1	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
39	$14,350,000	Distribution System - Standard Developer Agreements	Expansion	Water Distribution	$150,000	Compliance:	1	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	5		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
57	$14,600,000	Water Emergency Repair	Rehab or Replace Assets	Water Distribution	$250,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
110	$15,100,000	Generator Rehab and Replacement Program (AMP)	Rehab or Replace Assets	Other	$500,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
131	$16,300,000	Southside WWTP - Interim Rehabilitation Phase II	Rehab or Replace Assets	Wastewater Treatment	$1,200,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
134	$16,600,000	Large Water Meter Vault Replacement	Rehab or Replace Assets	Water Distribution	$300,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
143	$21,100,000	PS-9 Walnut Street Pump Station Replacement	Rehab or Replace Assets	Wastewater Collection	$4,500,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
162	$22,600,000	Chestnut and Grace Water Rehabilitation	Rehab or Replace Assets	Water Distribution	$1,500,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
169	$22,750,000	Southside WWTP - Copper Coagulant Chemical Feed System	Enhancement	Wastewater Treatment	$150,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
170	$23,500,000	Northside WWTP - Interim Facility Improvements	Rehab or Replace Assets	Wastewater Treatment	$750,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
171	$25,000,000	Chestnut and Grace Sewer Rehabilitation	Rehab or Replace Assets	Wastewater Collection	$1,500,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.

Reference Number	Running Cumulative FY-23 Total	Project Name	Project Type	Project Area	FY-23 Budget	Project Drivers and Benefits			
30	$25,150,000	Information Technology Networking Infrastructure Replacement	Rehab or Replace Assets	Other	$150,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
34	$26,350,000	Motor Fleet Capital	Rehab or Replace Assets	Other	$1,200,000	Compliance:	2	10	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	3		Energy savings, reduced carbon footprint, climate change adaptation.
138	$26,950,000	Groundwater Well Rehabilitation (AMP)	Rehab or Replace Assets	Water Treatment	$600,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
145	$28,250,000	PS-14 Greenfield Lake FM Rehab/Replace	Rehab or Replace Assets	Wastewater Collection	$1,300,000	Compliance:	4	10	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
150	$28,450,000	Large Meter Replacement Program	Rehab or Replace Assets	Water Distribution	$200,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
152	$28,600,000	Kings Bluff Intake Canal Dredging and Rehabilitation	Rehab or Replace Assets	Water Treatment	$150,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
160	$28,800,000	Porter's Neck Booster Pump Station Rehabilitation	Rehab or Replace Assets	Water Distribution	$200,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
161	$29,300,000	Elevated Tank SCADA Standardization Upgrades	Enhancement	Water Distribution	$500,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
175	$30,500,000	PS-35 Force Main Redirect and Junction Box Rehabilitation	Rehab or Replace Assets	Wastewater Collection	$1,200,000	Compliance:	4	10	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
53	$31,350,000	Elevated Tank Rehabilitation and Coatings	Rehab or Replace Assets	Water Distribution	$850,000	Compliance:	3	9	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
96	$35,550,000	Twin 24 Raw Water Transmission Mains	Rehab or Replace Assets	Water Treatment	$4,200,000	Compliance:	3	9	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
136	$35,950,000	Facilities Structural and Roof Assessment and Rehab/Replace (AMP)	Rehab or Replace Assets	Other	$400,000	Compliance:	3	9	Current and future regulatory compliance, including safety and water quality.
						Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
						Capacity/Growth:	1		Additional capacity and/or customers served.
						Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
		OVERALL TOTAL			**$35,950,000**				

*These growth projects may have substantial capital cost recovery from new customers or other stakeholders. The entire project amount is programmed to allow construction prior to cost recovery.



REFERENCE NUMBER	Sewer Emergency Repair	17S393
1		
Project Type:	Rehab or Replace Assets	
Project Area:	Wastewater Collection	

Summary:

This project funds emergency repair of sewer infrastructure if there is a failure prior to programmed replacement or rehabilitation.

Spending on sewer emergency repair in the last 5-years was as follows:

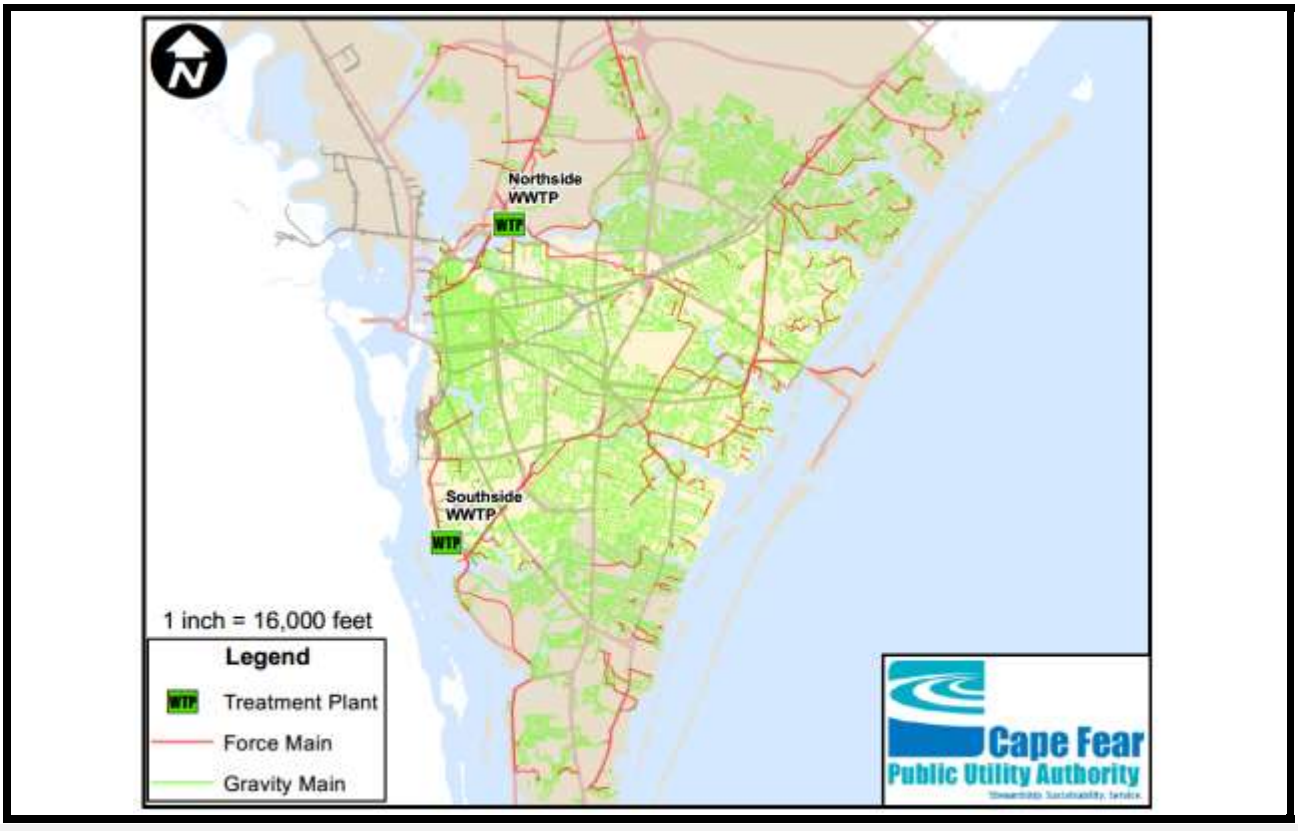
FY-21 - $411,713; FY-20 - $244,000; FY-19 - $1,740,486; FY-18 - $2,023,733; FY-17 - $355,211.



Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$21,000,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$1,500,000	$500,000	$4,500,000





REFERENCE NUMBER	Find It, Fix It Methodology Sewer Collection Rehabilitation (AMP)	17S394
4		
Project Type:	Rehab or Replace Assets	
Project Area:	Wastewater Collection	

Summary:

Areas of our collection system are beyond their designed life cycle. Utilizing asset management principles, including risk mitigation, and remaining useful life, assets are prioritized to be rehabbed or replaced. The focus during FY-2023 remains on rehabilitating or replacing gravity sewer mains that are over 70 years old in downtown Wilmington and the surrounding vicinity. CFPUA has approximately 915 miles of gravity sewer. Approximately 110 miles of gravity sewer mains in the City are over 70 years old.



Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$56,200,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$18,200,000	$1,000,000	$37,000,000





REFERENCE NUMBER	Water Main, Services and Valve Rehab/Replace (AMP)	17W244
27		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Distribution	

Summary:

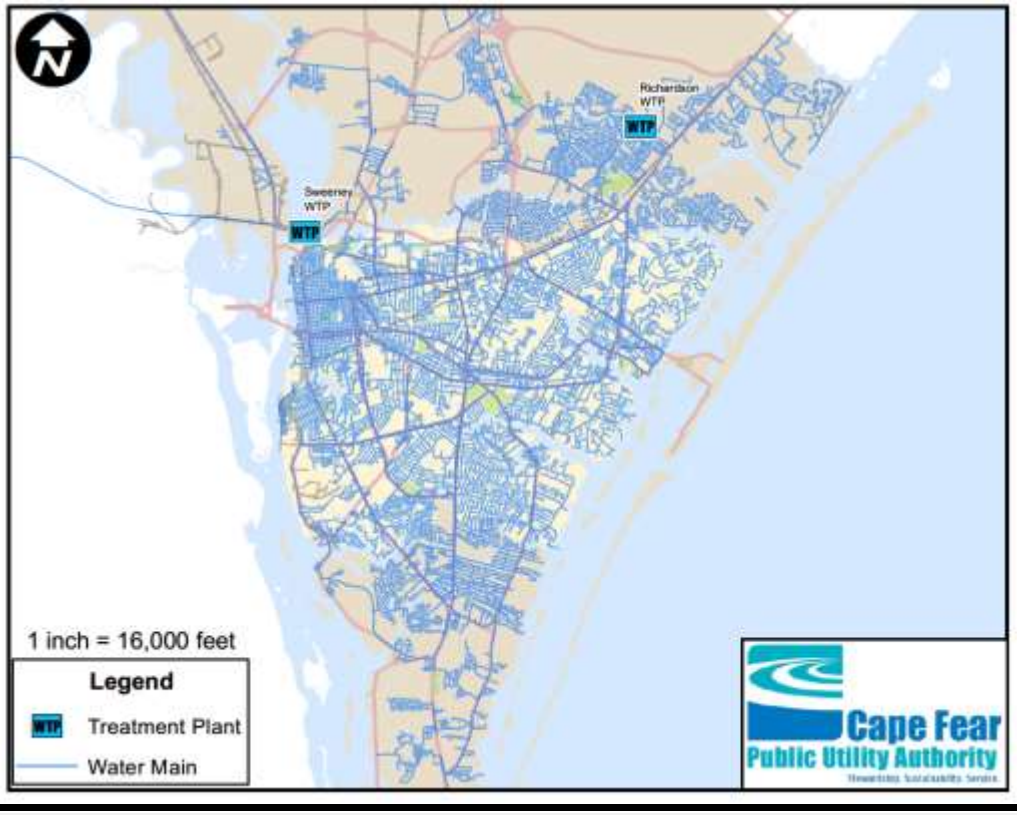
Areas of our distribution system are beyond their designed life cycle. Utilizing asset management principles, including risk mitigation, and remaining useful life, assets are prioritized to be rehabbed or replaced. The focus during FY-2023 remains on replacing or rehabilitating water distribution mains and valves that are over 70 years old in downtown Wilmington and the surrounding vicinity. Water services are composed of galvanized pipe and lead goosenecks are being inventoried and replaced in these projects. CFPUA has approximately 1,144 miles of water distribution mains. Approximately 165 miles of water mains in the City are over 70 years old.



Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$60,100,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$2,000,000	$2,300,000	$54,600,000





REFERENCE NUMBER	Information Technology Networking Infrastructure Replacement	16A007
30		
Project Type:	Rehab or Replace Assets	
Project Area:	Other	

Summary:

In 2008 the Information Technology Division purchased various electronics (Firewalls, Switches, Routers) to connect the Administrative building and the other CFPUA facilities to one another. These devices provide intelligent routing and segmenting for various (Data, Voice, SCADA) applications, security from outside networks, Internet access, and virus protection for the Authority. This project replaces that equipment in a prioritized manner across multiple years. Some equipment will be replaced only after it fails or is obsolete to extract maximum value and service life.



Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$3,619,388	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$2,119,388	$150,000	$1,350,000





REFERENCE NUMBER	Motor Fleet Capital	17A013
34		
Project Type:	Rehab or Replace Assets	
Project Area:	Other	

Summary:

CFPUA developed a long-term model for motor fleet replacements based on predetermined criteria. Each of these vehicles will be evaluated based on maintenance records and history. Replacement of those that can be extended in life cost effectively will be deferred. Fleet capital costs are an ongoing major capital expense. By setting aside regular appropriations of capital each year, the Authority is better financially prepared to prevent unplanned funding demands due to motor fleet expenses, without adequate resources.

Motor Fleet investments support the Authority's sustainability goals by increasing the population of electric vehicles in the fleet, where operational requirements can be met by these vehicles.



Project Drivers and Benefits:

- Compliance 2: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 3: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$13,626,197	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$4,326,197	$1,200,000	$8,100,000



This Project Is Not Risk Driven

REFERENCE NUMBER	Collection System - Standard Developer Agreements	17S399
38		
Project Type:	Expansion	
Project Area:	Wastewater Collection	

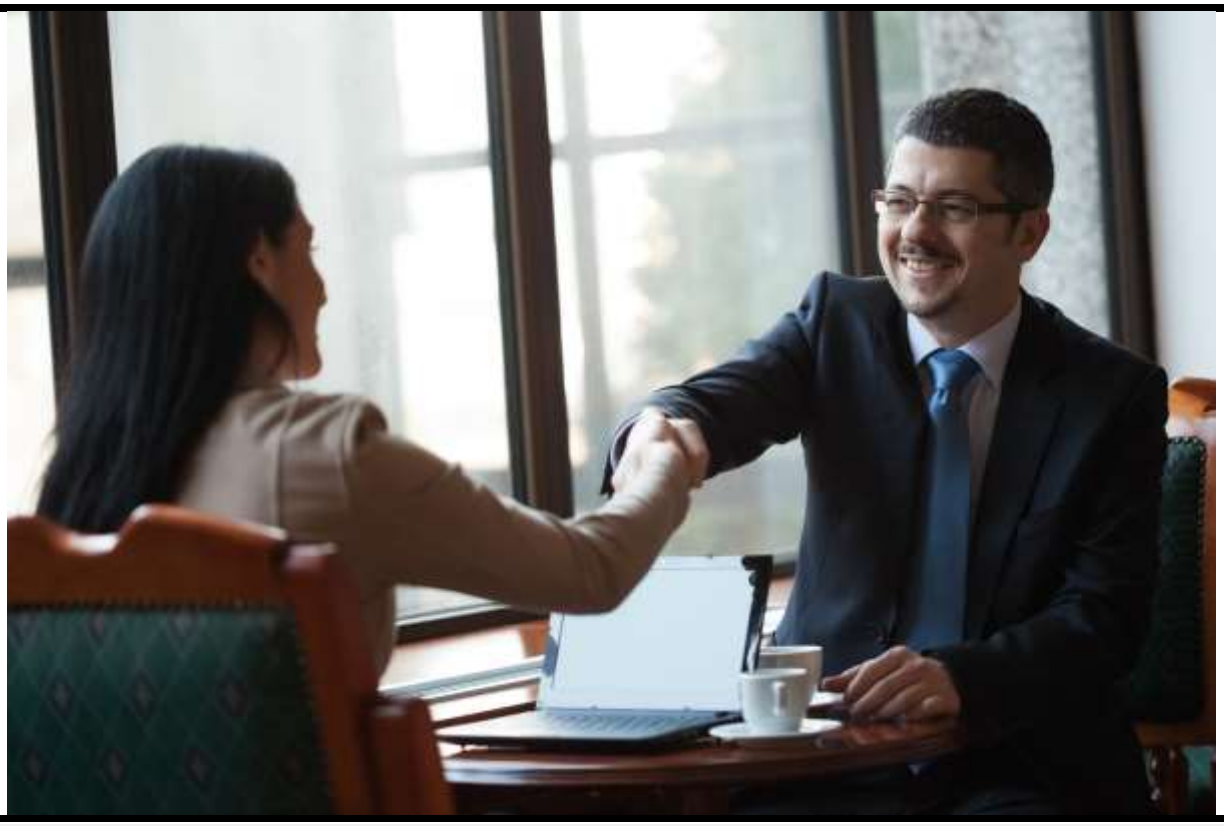
Summary:
Annual funds allocated to standard developer agreements. Provides cost sharing opportunities with private developers, decreasing overall cost of infrastructure and provides opportunities to increase customer base.



Project Drivers and Benefits:

- Compliance 1: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$2,600,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$1,100,000	$150,000	$1,350,000



This Project Is Not Risk Driven

REFERENCE NUMBER	Distribution System - Standard Developer Agreements	17W248
39		
Project Type:	Expansion	
Project Area:	Water Distribution	

Summary:
Annual funds allocated to standard developer agreements. Provides cost sharing opportunities with private developers, decreasing overall cost of infrastructure and provides opportunities to increase customer base.



Project Drivers and Benefits:

- Compliance 1: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$2,600,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$1,100,000	$150,000	$1,350,000





REFERENCE NUMBER	OPS Large Equipment Purchases (Pumps, Plant Equipment, HVAC)	17A012
40		
Project Type:	Rehab or Replace Assets	
Project Area:	Other	

Summary:
This project funds replacement of large equipment such as HVAC, pumps and other equipment replacements large enough to be a capital project for any facility arising due to unplanned but non-emergency system failures that occur during the year.



Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$13,851,307	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$1,500,000	$1,000,000	$9,000,000





REFERENCE NUMBER	Elevated Tank Rehabilitation and Coatings	18W002
53		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Distribution	

Summary:

Elevated tanks require renewal of engineered coatings periodically in order to extend the tank's useful life. Rehabilitation and replacement of tank appurtenances and structures is also required to extend life cycle. FY-23 provides funding for assessment and rehabilitation of existing storage tanks.



Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$7,290,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$990,000	$850,000	$5,450,000





REFERENCE NUMBER	Water Emergency Repair	16W223
57		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Distribution	

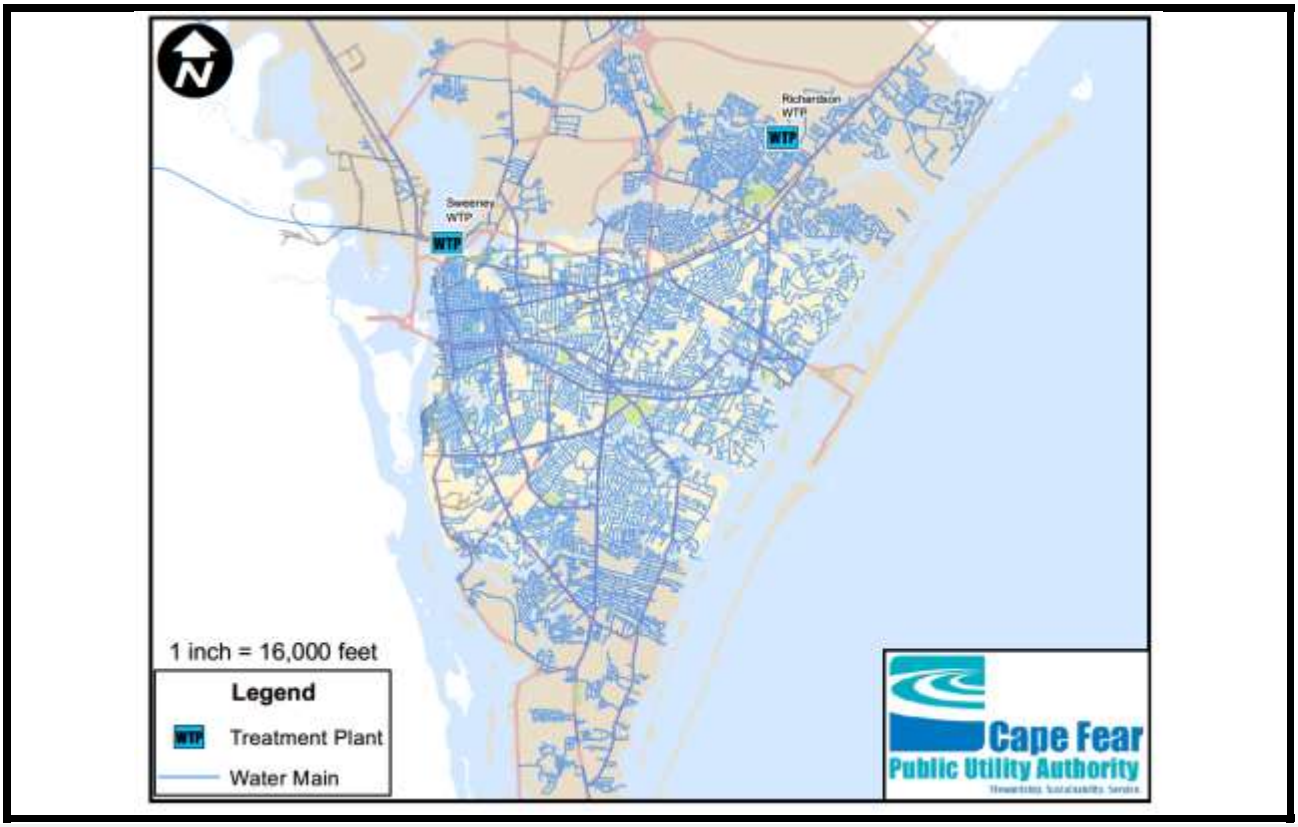
Summary:
Funding to address emergency water repair.
Spending on water emergency repair in the last 5 years was as follows:
FY-21 - $123,472; FY-20 - $221,000; FY-19 - $1,740,000; FY-18 - $229,000; FY-17 - $2,168,000.



Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$3,433,845	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$500,000	$250,000	$2,250,000





REFERENCE NUMBER	Twin 24 Raw Water Transmisson Mains	20W001
96		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Treatment	

Summary:

Two aerial 24-inch diameter raw water mains are set on pilings directly in the flow path of the Lower Cape Fear River and Toomers Creek during flood events, such as experienced in September 2018 during Hurricane Florence. In addition, these mains are parallel to active railroad tracks subject to damage in the event of a rail accident. These mains convey 10 million gallons per day (MGD) of CFPUA's raw water supply. These 24-inch cast iron pipes are above grade on wooden pier supports. The north main was installed in the 1920s and the south main was installed in the 1950s. The cast iron pipe itself was deemed to be structurally sound in 2009. However, failing wooden pilings, leaking lead joints and potential exposure to natural and manmade disasters elevate the risk of failure to a critical level. This project will rehabilitate or replace the most vulnerable portion of the infrastructure.



Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$12,300,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$8,100,000	$4,200,000	$0





REFERENCE NUMBER	Generator Rehab and Replacement Program (AMP)	18A001
110		
Project Type:	Rehab or Replace Assets	
Project Area:	Other	

Summary:

CFPUA owns approximately 150 standby generators that are critical for the reliable operation of its wastewater pumping stations and well sites. This project is to systemically replace aging generators. Generators at Richardson wells sites M, I and L all have over 1,500 hours run time and are scheduled for evaluation and possible replacement in FY-2023 along with several load transfer switches at wells and pump stations throughout the system. Run times between 1,500 and 2,000 hours are approaching end of lifecycle as indicated by work order history aggregated across the generator fleet.



Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$5,690,500	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$690,500	$500,000	$4,500,000







REFERENCE NUMBER	IT SCADA and Security	19A001
114		
Project Type:	Rehab or Replace Assets	
Project Area:	Other	

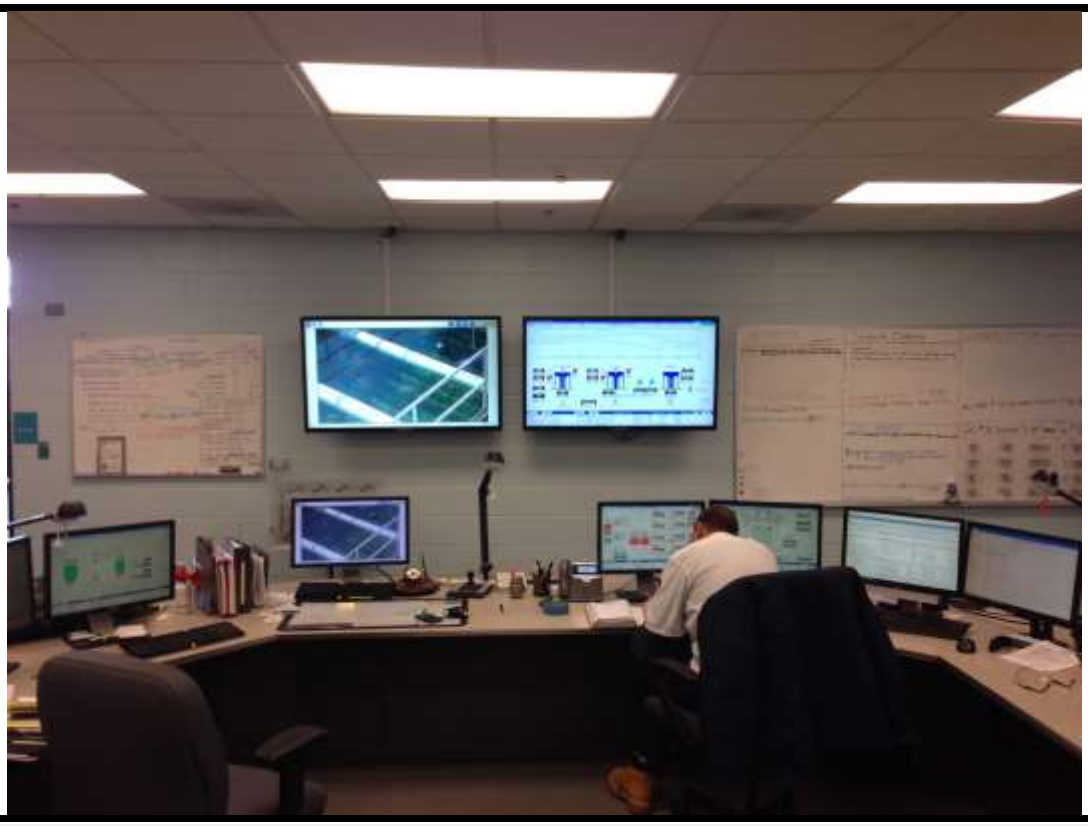
Summary:

The SCADA system at CFPUA's facilities are becoming obsolete. Due to cyber security demands, standardization, centralized management, and to reduce future integration costs, SCADA is being migrated to an updated HMI platform. All hardware has been procured, configured and installed. Purchase and installation of new applications is planned at every plant over the next several years. SCADA controls are necessary for compliant and efficient operation of each facility and protecting the security of those assets is an ongoing effort that requires annual funding.

Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$8,477,968	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$977,968	$750,000	$6,750,000





REFERENCE NUMBER	Pump Stations Prioritization and Rehabilitation	19S003
126		
Project Type:	Rehab or Replace Assets	
Project Area:	Wastewater Collection	

Summary:

CFPUA has 13 sewer pump stations that are known to be past 40 years old and in need of rehabilitation or replacement. Through asset management, staff annually evaluates these pump stations for condition and consequence. Design and construction of replacement or rehabilitation of PS-41 and PS-61 were the investment in FY-2022. Due to increased construction costs and staff developing a more sustainable opportunity to eliminate PS-61 entirely (pending potential issuance of an NCDEQ variance that would allow construction of gravity sewer at a flatter slope), the FY-2023 investment will be directed towards completing those previously identified pump stations.



Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 3: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$11,321,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$1,321,000	$1,000,000	$9,000,000







REFERENCE NUMBER	Southside WWTP - Interim Rehabilitation Phase II	
131		
Project Type:	Rehab or Replace Assets	
Project Area:	Wastewater Treatment	

Summary:

Mechanical components of the headworks at the Southside Wastewater Treatment Plant have exceeded their lifecycle and rehabilitation needs to be completed to reduce risk and ongoing repair costs. This includes the mechanical bar screen and the grit removal mechanism, and repurposing the former chlorine building to a maintenance facility.

Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$2,950,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$1,750,000	$1,200,000	$0





REFERENCE NUMBER	Large Water Meter Vault Replacement	17W262
134		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Distribution	

Summary:
Replace or repair large meter vaults or meter vault lids that may pose a hazard to the public and CFPUA personnel because of condition. Currently there are over 50 vaults identified that need work.



Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$4,088,455	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$1,088,455	$300,000	$2,700,000





REFERENCE NUMBER	Facilities Structural and Roof Assessment and Rehab/Replace (AMP)	20A001
136		
Project Type:	Rehab or Replace Assets	
Project Area:	Other	

Summary:

CFPUA assets include buildings, tanks and other structures made of concrete, steel and other materials approaching end of lifecycle. This project assesses, prioritizes, rehabs, or replaces damaged areas of these structures. Roofs and structures that are passed their lifecycle at the Southside Plant are high priorities so that the life of the plant can be extended until the major rehabilitation and capacity upgrade can be completed.



Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$4,760,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$160,000	$400,000	$4,200,000





REFERENCE NUMBER	Groundwater Well Rehabilitation (AMP)	20W009
138		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Treatment	

Summary:
The Authority manages over fifty groundwater wells and continually replaces or rehabilitates components of this infrastructure to meet service levels.



Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$4,658,316	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$2,058,316	$600,000	$2,000,000







REFERENCE NUMBER	PS-9 Walnut Street Pump Station Replacement	12S173
143		
Project Type:	Rehab or Replace Assets	
Project Area:	Wastewater Collection	

Summary:
This Project replaces existing Walnut St Sewer Pump Station (PS-9) which was built in 1970, which is rated at 1.872 MGD with a new sewer pump station rated at 1.613 MGD. Included in the scope of this project is to remove Market St Sewer Pump Station (PS-11), which is part of the existing flow to PS-9 via force main and connect this flow through approximately 1800 feet of 16-inch PVC C905 gravity sewer.

Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$8,400,068	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$3,900,068	$4,500,000	$0







REFERENCE NUMBER	PS-14 Greenfield Lake FM Rehab/Replace	18S004
145		
Project Type:	Rehab or Replace Assets	
Project Area:	Wastewater Collection	

Summary:

The PS-14 force main is over 45 years old and is one of the highest risk force mains. Concrete pipe material (PCCP) of the force main makes it difficult to do emergency repairs. The force main is approaching the end of its life cycle.

Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$13,142,985	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$11,842,985	$1,300,000	$0







REFERENCE NUMBER	Large Meter Replacement Program	
150		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Distribution	

Summary:

CFPUA has approximately 310 large water meters (3-inches or larger). A majority of these meters are approaching the end of their useful life, meaning a reduction in reading accuracy. A previous project replaced meters smaller than 3-inches in diameter. This project addresses the need to properly bill our largest water customers.

Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$2,357,456	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$357,456	$200,000	$1,800,000





REFERENCE NUMBER	Kings Bluff Intake Canal Dredging and Rehabilitation	
152		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Treatment	

Summary:
The Authority's raw water intake at Kings Bluff depends upon a canal between the river and the pumping facility. This project restores the cross-sectional area and depth of the canal by dredging sediment that has accumulated since its last maintenance event.



Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$1,450,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$600,000	$150,000	$700,000



This Project Is Not Risk Driven

REFERENCE NUMBER	Water System Master Plan	
153		
Project Type:	Expansion	
Project Area:	Water Distribution	

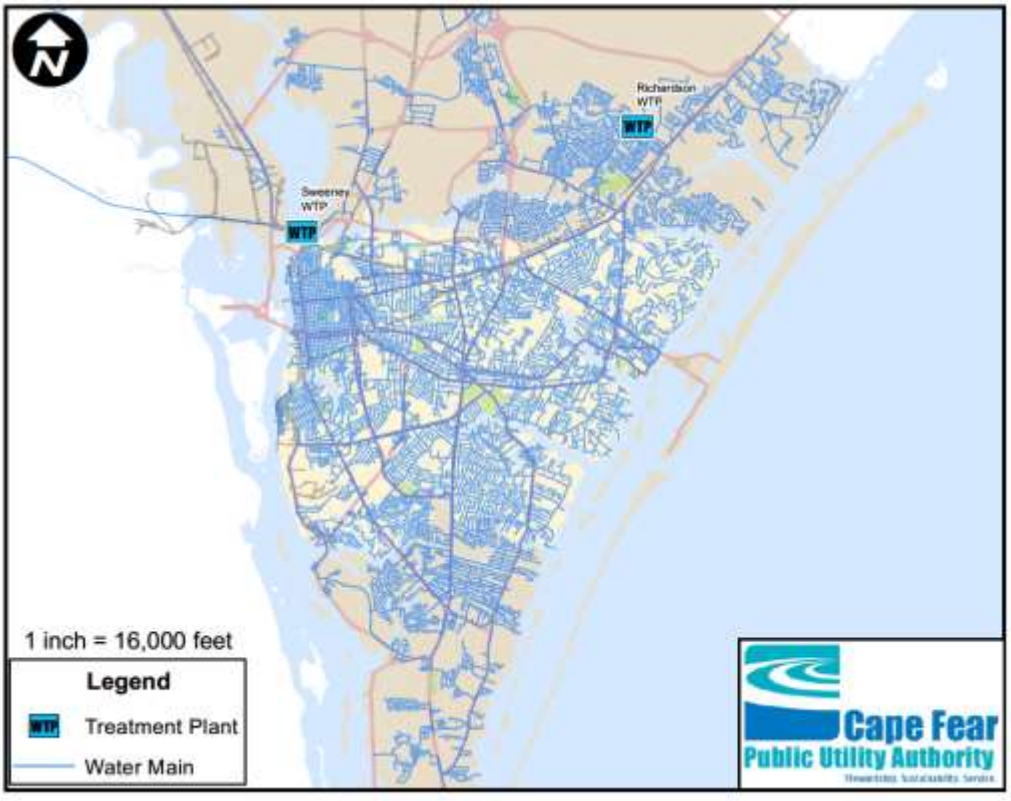
Summary:
The Water Master Plan evaluates and optimizes the investment in the water treatment and distribution system to keep pace with capacity needs and identify more efficient patterns of operation based on evaluating past hydraulic and operational data.

Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 4: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$700,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$100,000	$300,000	$300,000





This Project Is Not Risk Driven

REFERENCE NUMBER	Southern NHC Regional Pump Station	
154		
Project Type:	Expansion	
Project Area:	Wastewater Collection	

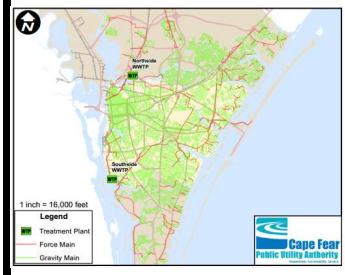
Summary:

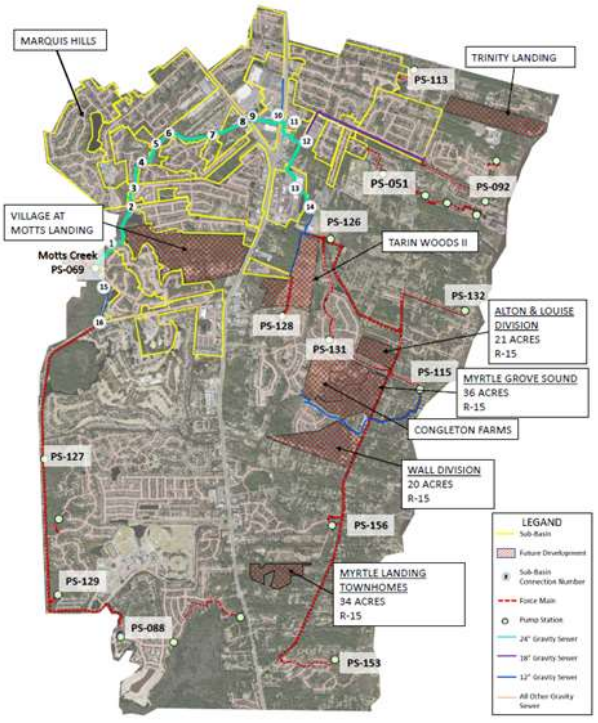
The rate and density of growth in southern New Hanover County will generate more sewer flows than existing infrastructure will be able to convey in the future. Existing infrastructure was planned and sized decades ago before new growth patterns were evident. This project will construct a regional pump station that will redirect wastewater flow away from Motts Creek Gravity Sewer Outfall to provide capacity for future growth in this basin.

Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 3: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$5,741,631	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$3,891,631	$1,850,000	$0





This Project Is Not Risk Driven

REFERENCE NUMBER	South Castle Hayne Road Water Main	155
155		
Project Type:	Expansion	
Project Area:	Water Distribution	

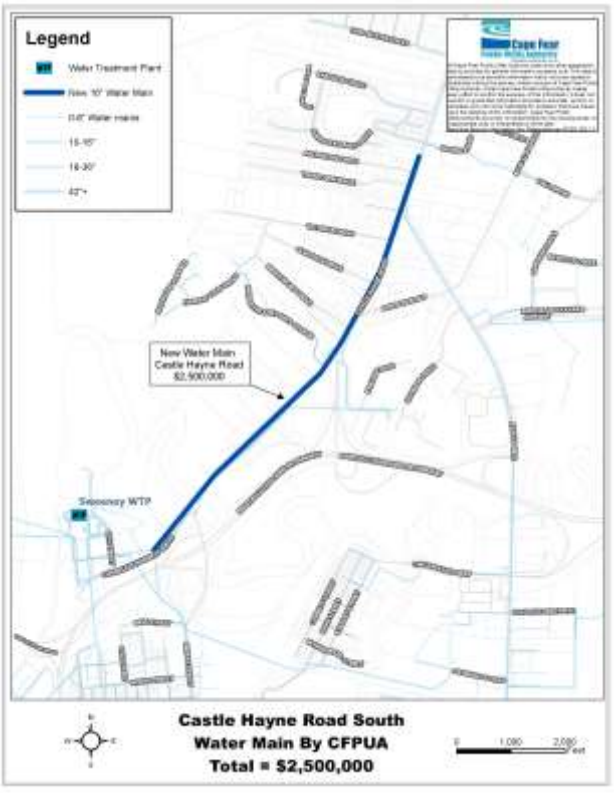
Summary:
South Castle Hayne Water Main installs approximately 9,300 feet of new 16-inch water from the vicinity of Sweeney Water Treatment Plant up Castle Hayne Road to the vicinity of the Kerr Avenue intersection. This pipe was identified in the Sidbury and Greenview Preliminary Engineering Report as being necessary to provide water capacity to planned development in the northern portion of New Hanover County.

This Project Is Not Risk Driven

Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$2,500,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$250,000	$2,250,000





REFERENCE NUMBER	Porter's Neck Booster Pump Station Rehabilitation	
160		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Distribution	

Summary:

The Porters Neck Booster Pump Station is essential infrastructure during high water demands during hot and dry seasons. It withdraws water stored in the Porters Neck Ground Storage Tank and distributes it using high service pumps currently located in a steel enclosure that was installed at the time of the original Porters Neck development approximately 30 years ago. The enclosure has rusted and corroded to the point that it will soon be unserviceable and unsafe unless replaced.



Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$1,200,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$200,000	$1,000,000





REFERENCE NUMBER	Elevated Tank SCADA Standardization Upgrades	
161		
Project Type:	Enhancement	
Project Area:	Water Distribution	

Summary:
Elevated Tank SCADA Standardization Upgrades provide increased efficiency, cyber security improvements, and improvements to water quality by reducing water age.



Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$500,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$500,000	$0





REFERENCE NUMBER	Chestnut and Grace Water Rehabilitation	
162		
Project Type:	Rehab or Replace Assets	
Project Area:	Water Distribution	

Summary:

Chestnut and Grace Water Rehabilitation is an initiative in cooperation with the City of Wilmington to Rehabilitate or Replace water infrastructure in advance of a significant paving job to improve the road surface by the City. The project will replace all galvanized water service lines in the area, including any lead goosenecks, valves and any mains that do not have extended life into the future. The project area covers the full extent of Chestnut and Grace Streets from the intersection of 3rd Street to the intersection of 17th Street and is associated with a sewer rehab project in the same area.



Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$1,500,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$1,500,000	$0





REFERENCE NUMBER	River Road Booster Pump Station and Interconnections	
163		
Project Type:	Expansion	
Project Area:	Water Distribution	

Summary:

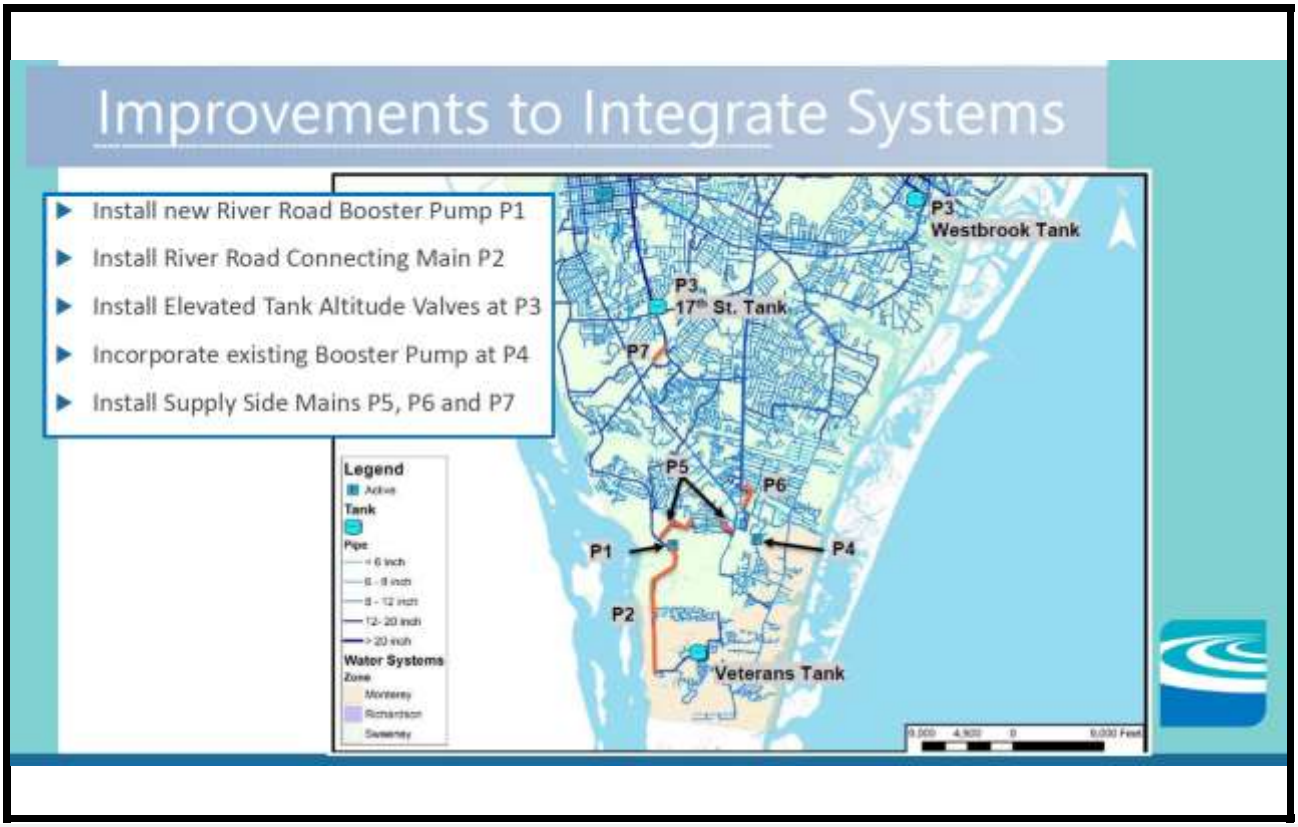
River Road Booster Pump Station and Interconnections project will enable the existing Monterey Heights Groundwater System to be supplied by Sweeney Water Treatment Plant. This will enable all groundwater wells in New Hanover County to become emergency wells, reducing reliance on aquifers and reducing operating costs to operate and maintain the wells. The project will strengthen interconnectivity at key areas of the Authority's water system, including a booster pump and 16-inch water main extension from RiverLights to Veteran's Park.



Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$10,000,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$1,000,000	$9,000,000





REFERENCE NUMBER	Gordon Road Interconnection with NCDOT	
165		
Project Type:	Expansion	
Project Area:	Water Distribution	

Summary:

Gordon Road Water Mains Interconnection with NCDOT will fund installation of water main interconnections along Gordon Road before NCDOT widens the road, greatly increasing the price of future improvements. Enhanced interconnections now will increase the interconnectivity between the Sweeney supplied system and the Richardson supplied system. This will increase overall system resilience and improve water quality by eliminating dead end mains.



Project Drivers and Benefits:

- Compliance 3: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$1,000,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$1,000,000	$0



This Project Is Not Risk Driven

REFERENCE NUMBER	Oakley Area Water Grant Application	
167		
Project Type:	Expansion	
Project Area:	Water Distribution	

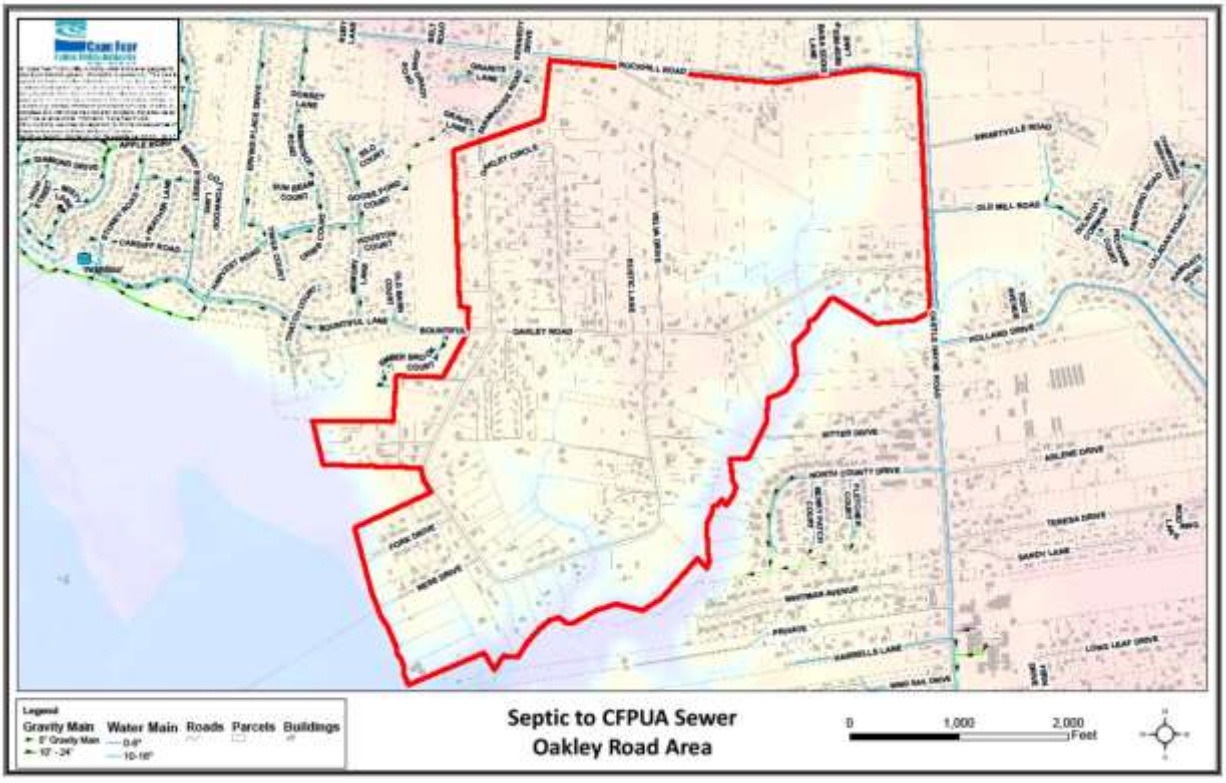
Summary:
Oakley Area Well to Water Service project results from a grant opportunity to provide water distribution service to under-served areas that are on individual private wells for water supply. This project and the associated septic to sewer service project are contingent upon receipt of grant funding.

This Project Is Not Risk Driven

Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 2: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$2,000,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$200,000	$1,800,000



This Project Is Not Risk Driven

REFERENCE NUMBER	Alandale Area Water Grant Application	
168		
Project Type:	Expansion	
Project Area:	Water Distribution	

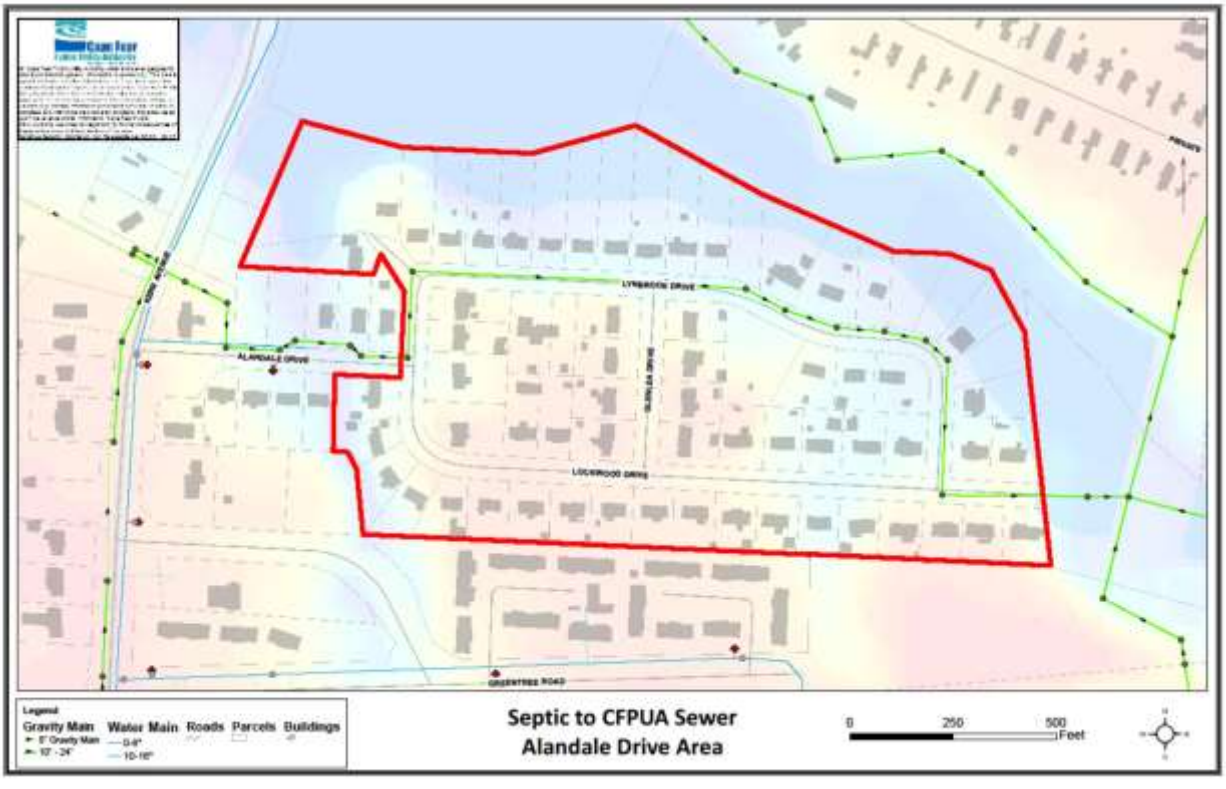
Summary:
Alandale Area Well to Water Service project results from a grant opportunity to provide water distribution service to under-served areas that are on individual private wells for water supply. This project and the associated septic to sewer service project are contingent upon receipt of grant funding.

This Project Is Not Risk Driven

Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 2: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$1,000,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$100,000	$900,000





REFERENCE NUMBER	Southside WWTP - Copper Coagulant Chemical Feed System	
169		
Project Type:	Enhancement	
Project Area:	Wastewater Treatment	

Summary:

Southside WWTP – Copper Coagulant Chemical Feed System project is necessary to meet new National Pollutant Discharge Elimination System limits for copper at the effluent discharge point of Southside WWTP. The Southside WWTP Upgrade project will meet these requirements when it is completed in the future. In the interim, this project is needed to inject coagulants to remove copper from the discharge.



Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$1,100,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$150,000	$950,000





REFERENCE NUMBER	Northside WWTP - Interim Facility Improvements	
170		
Project Type:	Rehab or Replace Assets	
Project Area:	Wastewater Treatment	

Summary:

Northside WWTP Interim Facility Improvements will provide improvements to the existing Northside WWTP that will enhance worker safety by providing protected walkways and improve plant efficiency by replacing equipment that is past its lifecycle.



Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$750,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$750,000	$0





REFERENCE NUMBER	Chestnut and Grace Sewer Rehabilitation	
171		
Project Type:	Rehab or Replace Assets	
Project Area:	Wastewater Treatment	

Summary:

Chestnut and Grace Sewer Rehabilitation is an initiative in cooperation with the City of Wilmington to Rehabilitate or Replace sewer infrastructure in advance of a significant paving job to improve the road surface by the City. The project will conduct point repairs to damaged pipe in advance of lining and replace any failing manholes or sewer services that cannot be rehabilitated later. The project area covers the full extent of Chestnut and Grace Streets from the intersection of 3rd Street to the intersection of 17th Street and is associated with a water rehab project in the same area.



Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$1,500,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$1,500,000	$0





REFERENCE NUMBER	PS-35 Force Main Redirect and Junction Box Rehabilitation	
175		
Project Type:	Rehab or Replace Assets	
Project Area:	Wastewater Collection	

Summary:

By redirecting a major force main from a manhole to a large junction box with odor treatment, the PS-35 Force Main Redirect and Junction Box Rehabilitation corrects conditions at the Bradley Creek Pump Station that may be contributing to excess odor at the station and rehabilitates or replaces onsite manholes and mains that are past their lifecycle.



Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 4: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$1,200,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$1,200,000	$0



This Project Is Not Risk Driven

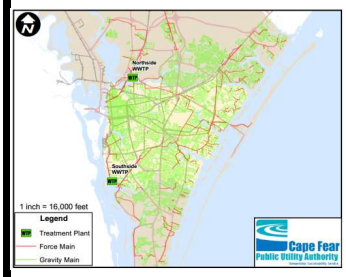
REFERENCE NUMBER	Wet Weather Model Development	
177		
Project Type:	Enhancement	
Project Area:	Wastewater Collection	

Summary:
In order to get a better understanding wastewater system capacity specifically as it pertains to gravity sewer, pump stations and force mains, CFPUA is having a wet weather model built and calibrated. The wet weather model will provide the organization with an understanding of system limitations due to inflow and infiltration from runoff and groundwater flows. This will help staff determine areas where reduction of inflow and infiltration will provide the greatest benefit by increasing available capacity and reducing the cost of system operation.

Project Drivers and Benefits:

- Compliance 4: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 2: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$500,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$500,000	$0





This Project Is Not Risk Driven

REFERENCE NUMBER	Oakley Area Septic to Sewer Grant Application	
178		
Project Type:	Expansion	
Project Area:	Wastewater Collection	

Summary:

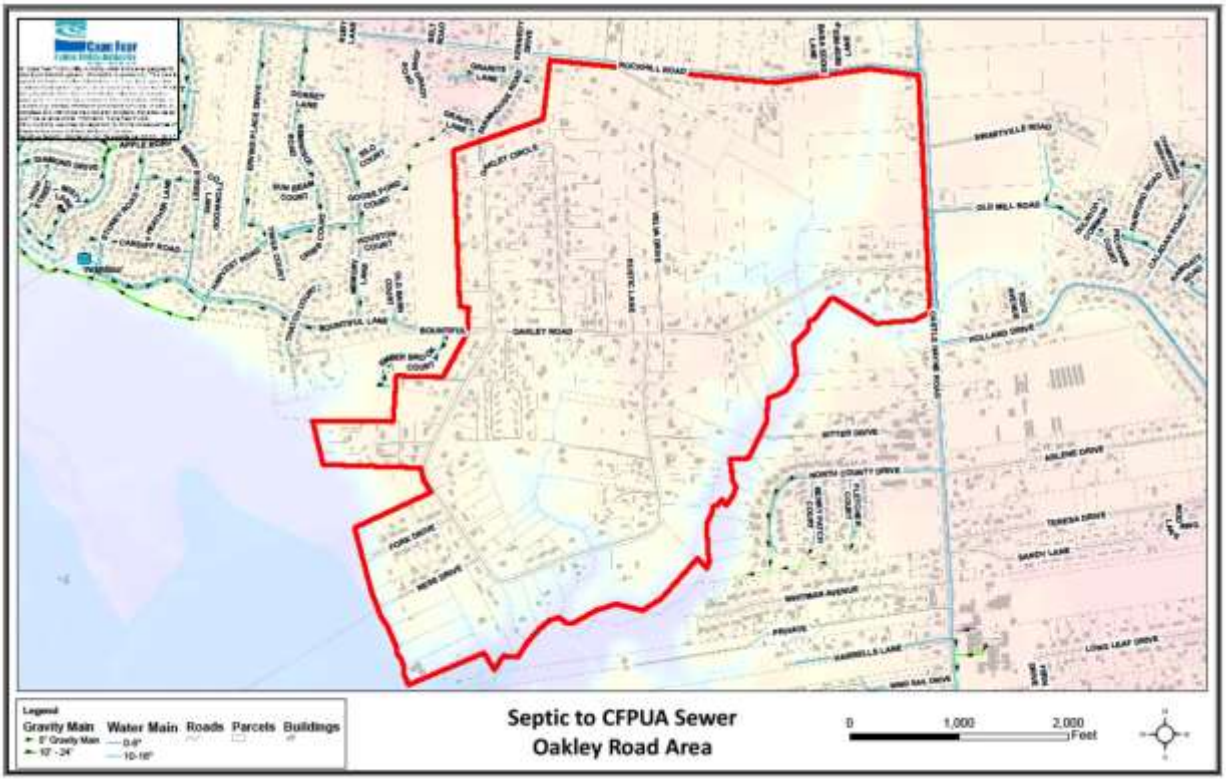
Alandale Area Septic to Sewer Service project results from a grant opportunity to provide sewer service to under-served areas that are on individual septic tanks for wastewater treatment. This project and the associated well to water service project are contingent upon receipt of grant funding.

This Project Is Not Risk Driven

Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 2: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$10,000,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$1,000,000	$9,000,000



This Project Is Not Risk Driven

REFERENCE NUMBER	Alandale Area Sewer Grant Application	
179		
Project Type:	Expansion	
Project Area:	Wastewater Collection	

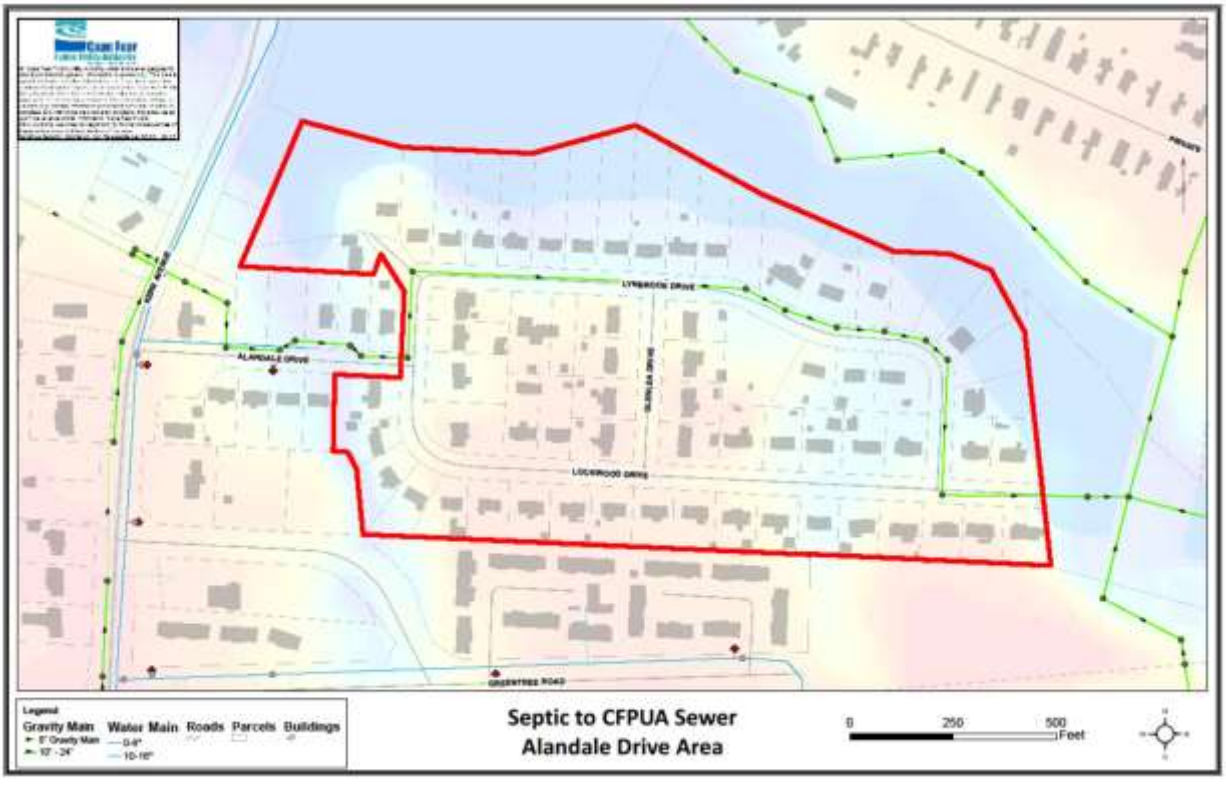
Summary:
Alandale Area Septic to Sewer Service project results from a grant opportunity to provide sewer service to under-served areas that are on individual septic tanks for wastewater treatment. This project and the associated well to water service project are contingent upon receipt of grant funding.

This Project Is Not Risk Driven

Project Drivers and Benefits:

- Compliance 5: Current and future regulatory compliance, including safety and water quality.
- Efficiency 2: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 5: Additional capacity and/or customers served.
- Sustainability 1: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$2,000,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$300,000	$1,700,000



This Project Is Not Risk Driven

REFERENCE NUMBER	Sustainability Program	
182		
Project Type:	Enhancement	
Project Area:	Other	

Summary:

Sustainability Program Capital Project funding enables Authority investment in capital projects to increase sustainability or resiliency of Authority infrastructure. Improving energy efficiency, decreasing emissions, or reducing net carbon impacts are typical, but not exclusive opportunities. Sustainability program funding may be used to initiate a new project or augment an existing project to enhance the sustainability or resilience of planned infrastructure.

This Project Is Not Risk Driven

Project Drivers and Benefits:

- Compliance 1: Current and future regulatory compliance, including safety and water quality.
- Efficiency 5: Leading to future operating or capital savings, including customer service and financing options.
- Capacity/Growth 1: Additional capacity and/or customers served.
- Sustainability 5: Energy savings, reduced carbon footprint, climate change adaptation.

Total Estimated Cost	$10,000,000	
Budgeted Prior To FY 2023	Requested FY 2023	Future Budget Needs
$0	$1,000,000	$9,000,000



FY 2023 Capital Improvements Highest to Lowest Project Budget Sort

Reference Number	Project Name	Project Type	Project Area	FY-23 Budget	Project Drivers and Benefits			
143	PS-9 Walnut Street Pump Station Replacement	Rehab or Replace Assets	Wastewater Collection	$4,500,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
96	Twin 24 Raw Water Transmission Mains	Rehab or Replace Assets	Water Treatment	$4,200,000	Compliance:	3	9	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
27	Water Main, Services and Valve Rehab/Replace (AMP)	Rehab or Replace Assets	Water Distribution	$2,300,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
154	Southern NHC Regional Pump Station	Expansion	Wastewater Collection	$1,850,000	Compliance:	3	12	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	3		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
162	Chestnut and Grace Water Rehabilitation	Rehab or Replace Assets	Water Distribution	$1,500,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
171	Chestnut and Grace Sewer Rehabilitation	Rehab or Replace Assets	Wastewater Collection	$1,500,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
145	PS-14 Greenfield Lake FM Rehab/Replace	Rehab or Replace Assets	Wastewater Collection	$1,300,000	Compliance:	4	10	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
131	Southside WWTP - Interim Rehabilitation Phase II	Rehab or Replace Assets	Wastewater Treatment	$1,200,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
175	PS-35 Force Main Redirect and Junction Box Rehabilitation	Rehab or Replace Assets	Wastewater Collection	$1,200,000	Compliance:	4	10	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
34	Motor Fleet Capital	Rehab or Replace Assets	Other	$1,200,000	Compliance:	2	10	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	3		Energy savings, reduced carbon footprint, climate change adaptation.
163	River Road Booster Pump Station and Interconnections	Expansion	Water Distribution	$1,000,000	Compliance:	4	16	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
165	Gordon Road Interconnection with NCDOT	Expansion	Water Distribution	$1,000,000	Compliance:	3	14	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
4	Find It, Fix It Methodology Sewer Collection Rehabilitation (AMP)	Rehab or Replace Assets	Wastewater Collection	$1,000,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.

Reference Number	Project Name	Project Type	Project Area	FY-23 Budget	Project Drivers and Benefits			
178	Oakley Area Septic to Sewer Grant Application	Expansion	Wastewater Collection	$1,000,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	2		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
40	OPS Large Equipment Purchases (Pumps, Plant Equipment, HVAC)	Rehab or Replace Assets	Other	$1,000,000	Compliance:	4	12	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
126	Pump Stations Prioritization and Rehabilitation	Rehab or Replace Assets	Wastewater Collection	$1,000,000	Compliance:	4	12	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	3		Energy savings, reduced carbon footprint, climate change adaptation.
182	Sustainability Program	Enhancement	Other	$1,000,000	Compliance:	1	12	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	5		Energy savings, reduced carbon footprint, climate change adaptation.
53	Elevated Tank Rehabilitation and Coatings	Rehab or Replace Assets	Water Distribution	$850,000	Compliance:	3	9	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
114	IT SCADA & Security	Rehab or Replace Assets	Other	$750,000	Compliance:	5	12	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
170	Northside WWTP - Interim Facility Improvements	Rehab or Replace Assets	Wastewater Treatment	$750,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
138	Groundwater Well Rehabilitation (AMP)	Rehab or Replace Assets	Water Treatment	$600,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
177	Wet Weather Model Development	Enhancement	Wastewater Collection	$500,000	Compliance:	4	12	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
1	Sewer Emergency Repair	Rehab or Replace Assets	Wastewater Collection	$500,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
110	Generator Rehab and Replacement Program (AMP)	Rehab or Replace Assets	Other	$500,000	Compliance:	4	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
161	Elevated Tank SCADA Standardization Upgrades	Enhancement	Water Distribution	$500,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
136	Facilities Structural and Roof Assessment and Rehab/Replace (AMP)	Rehab or Replace Assets	Other	$400,000	Compliance:	3	9	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
153	Water System Master Plan	Expansion	Water Distribution	$300,000	Compliance:	3	13	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	4		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.

Reference Number	Project Name	Project Type	Project Area	FY-23 Budget	Project Drivers and Benefits			
179	Alandale Area Sewer Grant Application	Expansion	Wastewater Collection	$300,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	2		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
134	Large Water Meter Vault Replacement	Rehab or Replace Assets	Water Distribution	$300,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
155	South Castle Hayne Road Water Main	Expansion	Water Distribution	$250,000	Compliance:	3	13	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
57	Water Emergency Repair	Rehab or Replace Assets	Water Distribution	$250,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
167	Oakley Area Water Grant Application	Expansion	Water Distribution	$200,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	2		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
150	Large Meter Replacement Program	Rehab or Replace Assets	Water Distribution	$200,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
160	Porter's Neck Booster Pump Station Rehabilitation	Rehab or Replace Assets	Water Distribution	$200,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	2		Energy savings, reduced carbon footprint, climate change adaptation.
38	Collection System - Standard Developer Agreements	Expansion	Wastewater Collection	$150,000	Compliance:	1	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
39	Distribution System - Standard Developer Agreements	Expansion	Water Distribution	$150,000	Compliance:	1	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
169	Southside WWTP - Copper Coagulant Chemical Feed System	Enhancement	Wastewater Treatment	$150,000	Compliance:	5	11	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	4		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
30	Information Technology Networking Infrastructure Replacement	Rehab or Replace Assets	Other	$150,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
152	Kings Bluff Intake Canal Dredging and Rehabilitation	Rehab or Replace Assets	Water Treatment	$150,000	Compliance:	3	10	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	5		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	1		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
168	Alandale Area Water Grant Application	Expansion	Water Distribution	$100,000	Compliance:	5	13	Current and future regulatory compliance, including safety and water quality.
					Efficiency:	2		Leading to future operating or capital savings, including customer service and financing options.
					Capacity/Growth:	5		Additional capacity and/or customers served.
					Sustainability:	1		Energy savings, reduced carbon footprint, climate change adaptation.
	OVERALL TOTAL			**$35,950,000**				

*These growth projects may have substantial capital cost recovery from new customers or other stakeholders. The entire project amount is programmed to allow construction prior to cost recovery.

PROJECTED OPERATING BUDGET IMPACTS FROM FY-2023 CIP

Reference Number	Capital Project	Current Project #	Amount Budgeted Prior to FY-23	FY-23 Budgeted	FY-24 to FY-32 Annual Planned	Total Cumulative Project Cost Planned	Estimated Completion Fiscal Year	Quantifiable Annual Operating Budget Impact Expected	Unquantifiable Annual Operating Budget Impact Expected	Annual Operating Budget Impact Comments
All dollar amounts are shown in 2023 dollars. No adjustments are made for projected inflation or deflation.										
1	Sewer Emergency Repair	17S393	$16,500,000	$500,000	$4,500,000	$21,500,000	Annual		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
4	Find It, Fix It Methodology Sewer Collection Rehabilitation (AMP)	17S394	$18,200,000	$1,000,000	$37,000,000	$56,200,000	Annual		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
27	Water Main, Services and Valve Rehab/Replace (AMP)	17W244	$3,200,000	$2,300,000	$54,600,000	$60,100,000	Annual		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
30	Information Technology Networking Infrastructure Replacement	16A007	$2,119,388	$150,000	$1,350,000	$3,619,388	Annual		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
34	Motor Fleet Capital	17A013	$4,326,197	$1,200,000	$8,100,000	$13,626,197	Annual		Future Operating Budget Decrease	The project replaces fleet vehicles past their lifecycle with savings that cannot be quantified without implementation.
38	Collection System - Standard Developer Agreements	17S399	$1,100,000	$150,000	$1,350,000	$2,600,000	Annual		Future Operating Budget Increase	Revenues from any new customers expected to be offset by increased operating cost of new infrastructure.
39	Distribution System - Standard Developer Agreements	17W248	$1,100,000	$150,000	$1,350,000	$2,600,000	Annual		Future Operating Budget Increase	Revenues from any new customers expected to be offset by increased operating cost of new infrastructure.
40	OPS Large Equipment Purchases (Pumps, Plant Equipment, HVAC)	17A012	$3,851,307	$1,000,000	$9,000,000	$13,851,307	Annual		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
53	Elevated Tank Rehabilitation and Coatings	18W002	$990,000	$850,000	$5,450,000	$7,290,000	Annual		No Change To Future Operating Budget	This project maintains existing infrastructure to ensure stable operation over the infrastructure lifecycle.
57	Water Emergency Repair	16W223	$933,845	$250,000	$2,250,000	$3,433,845	Annual		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
96	Twin 24 Raw Water Transmisson Mains	20W001	$8,100,000	$4,200,000	$0	$12,300,000	Annual		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
110	Generator Rehab and Replacement Program (AMP)	18A001	$690,500	$500,000	$4,500,000	$5,690,500	Annual		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
114	IT SCADA and Security	19A001	$977,968	$750,000	$6,750,000	$8,477,968	2023		Future Operating Budget Decrease	The project enables process improvements that lead to efficiencies that cannot be quantified without implementation.
126	Pump Stations Prioritization and Rehabilitation	19S003	$1,321,000	$1,000,000	$9,000,000	$11,321,000	2023		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
131	Southside WWTP - Interim Rehabilitation Phase II	22S002	$1,750,000	$1,200,000	$0	$2,950,000	2026		Future Operating Budget Decrease	Replacement and improvements to major components at Southside WWTP increase efficiency and decrease operating costs.
134	Large Water Meter Vault Replacement	20W002	$1,088,455	$300,000	$2,700,000	$4,088,455	2026		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
136	Facilities Structural and Roof Assessment and Rehab/Replace (AMP)	20A001	$160,000	$400,000	$4,200,000	$4,760,000	2030		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
138	Groundwater Well Rehabilitation (AMP)	20W009	$2,058,316	$600,000	$2,000,000	$4,658,316	Annual		No Change To Future Operating Budget	This project maintains existing infrastructure to ensure stable operation over the infrastructure lifecycle.
143	PS-9 Walnut Street Pump Station Replacement	12S173	$3,900,068	$4,500,000	$0	$8,400,068	2026		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
145	PS-14 Greenfield Lake FM Rehab/Replace	18S004	$11,842,985	$1,300,000	$0	$13,142,985	Unknown		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
150	Large Meter Replacement Program	21W008	$357,456	$200,000	$1,800,000	$2,357,456	Annual		Future Operating Budget Decrease	This project replaces meters that are past their lifecycle. Metered water revenues may increase but cannot be quantified without implementation.
152	Kings Bluff Intake Canal Dredging and Rehabilitation	22W004	$600,000	$150,000	$700,000	$1,450,000	2026		No Change To Future Operating Budget	This project maintains existing infrastructure to ensure stable operation over the infrastructure lifecycle.
153	Water System Master Plan	22W005	$100,000	$300,000	$300,000	$700,000	2022		Future Operating Budget Decrease	The project enables process improvements that lead to efficiencies that cannot be quantified without implementation.

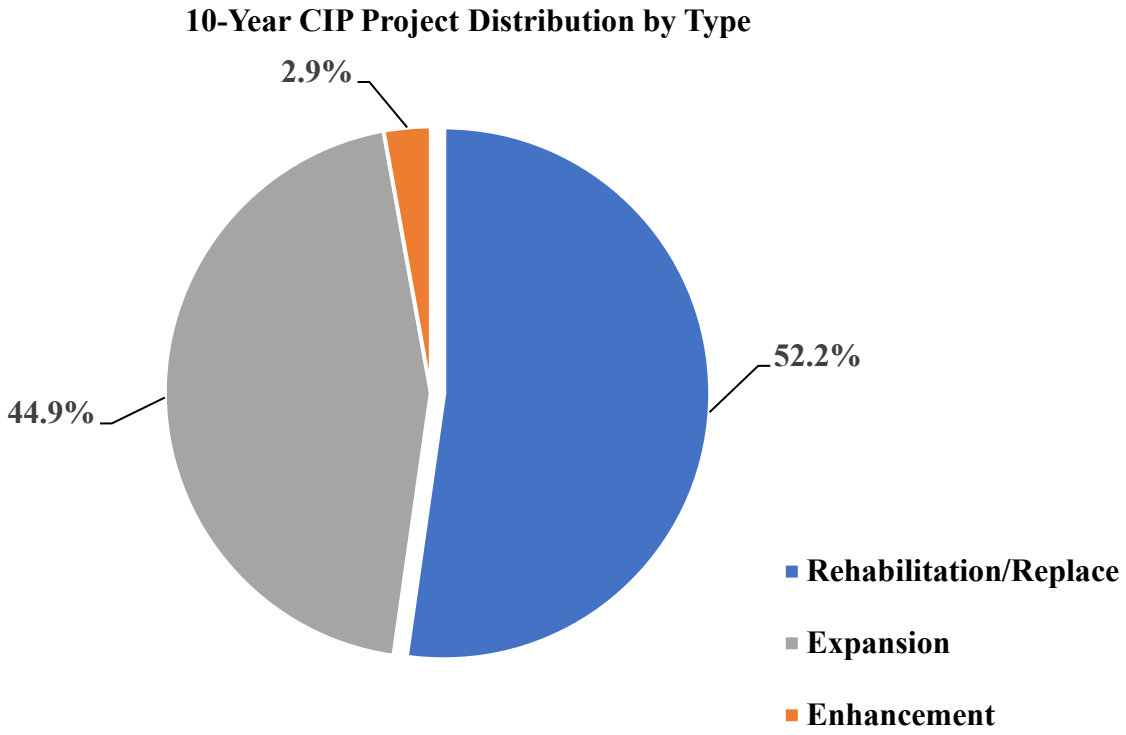
Reference Number	Capital Project	Current Project #	Amount Budgeted Prior to FY-23	FY-23 Budgeted	FY-24 to FY-32 Annual Planned	Total Cumulative Project Cost Planned	Estimated Completion Fiscal Year	Quantifiable Annual Operating Budget Impact Expected	Unquantifiable Annual Operating Budget Impact Expected	Annual Operating Budget Impact Comments
154	Southern NHC Regional Pump Station	21S008	$3,891,631	$1,850,000	$0	$5,741,631	2023		Future Operating Budget Increase	Revenues from any new customers expected are offset by increased operating cost of new infrastructure.
155	South Castle Hayne Road Water Main		$0	$250,000	$2,250,000	$2,500,000	2026		Future Operating Budget Increase	Revenues from any new customers expected are offset by increased operating cost of new infrastructure.
160	Porter's Neck Booster Pump Station Rehabilitation		$0	$200,000	$1,000,000	$1,200,000	2026		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
161	Elevated Tank SCADA Standardization Upgrades		$0	$500,000	$0	$500,000	2026		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
162	Chestnut and Grace Water Rehabilitation		$0	$1,500,000	$0	$1,500,000	2024		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
163	River Road Booster Pump Station and Interconnections		$0	$1,000,000	$9,000,000	$10,000,000	2025		Future Operating Budget Decrease	This project eliminates dependence existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
165	Gordon Road Interconnection with NCDOT		$0	$1,000,000	$0	$1,000,000	2026		No Change To Future Operating Budget	This project enhances existing infrastructure to ensure stable operation over the infrastructure lifecycle.
167	Oakley Area Water Grant Application		$0	$200,000	$1,800,000	$2,000,000	2026		Future Operating Budget Increase	Revenues from any new customers expected to be offset by increased operating cost of new infrastructure.
168	Alandale Area Water Grant Application		$0	$100,000	$900,000	$1,000,000	2026		Future Operating Budget Increase	Revenues from any new customers expected to be offset by increased operating cost of new infrastructure.
169	Southside WWTP - Copper Coagulant Chemical Feed System		$0	$150,000	$950,000	$1,100,000	2024		Future Operating Budget Increase	This project is required for compliance and will have some additional operating cost that cannot yet be quantified.
170	Northside WWTP - Interim Facility Improvements		$0	$750,000	$0	$750,000	2024		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
171	Chestnut and Grace Sewer Rehabilitation		$0	$1,500,000	$0	$1,500,000	2024		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
175	PS-35 Force Main Redirect and Junction Box Rehabilitation		$0	$1,200,000	$0	$1,200,000	2024		Future Operating Budget Decrease	This project rehabilitates existing infrastructure that is at the end of its lifecycle. Long term efficiency gains are expected but cannot yet be quantified.
177	Wet Weather Model Development		$0	$500,000	$0	$500,000	2024		Future Operating Budget Decrease	The project enables process improvements that lead to efficiencies that cannot be quantified without implementation.
178	Oakley Area Septic to Sewer Grant Application		$0	$1,000,000	$9,000,000	$10,000,000	2026		Future Operating Budget Increase	Revenues from any new customers expected to be offset by increased operating cost of new infrastructure.
179	Alandale Area Sewer Grant Application		$0	$300,000	$1,700,000	$2,000,000	2026		Future Operating Budget Increase	Revenues from any new customers expected to be offset by increased operating cost of new infrastructure.
182	Sustainability Program		$0	$1,000,000	$9,000,000	$10,000,000	Annual		Future Operating Budget Decrease	The project enables process improvements that lead to efficiencies that cannot be quantified without implementation.
	TOTAL CAPITAL IMPROVEMENT PROJECTS		**$89,159,116**	**$35,950,000**	**$192,500,000**	**$317,609,116**				

*These growth projects will have substantial capital cost recovery from new customers or other stakeholders. The entire project amount is programmed to allow construction prior to cost recovery.

Appendix B
Proposed Ten Year FY-2023 to FY-2032 Capital Improvement Plan

10-Year CIP Distribution By Project Type

Project Type	Percent	Ten Year Investment	No. of Projects
Rehabilitation/Replace	52.2%	$267,350,000	35
Expansion	44.9%	$229,750,000	21
Enhancement	2.9%	$14,600,000	6
Total	**100%**	**$511,700,000**	**62**



Categories:

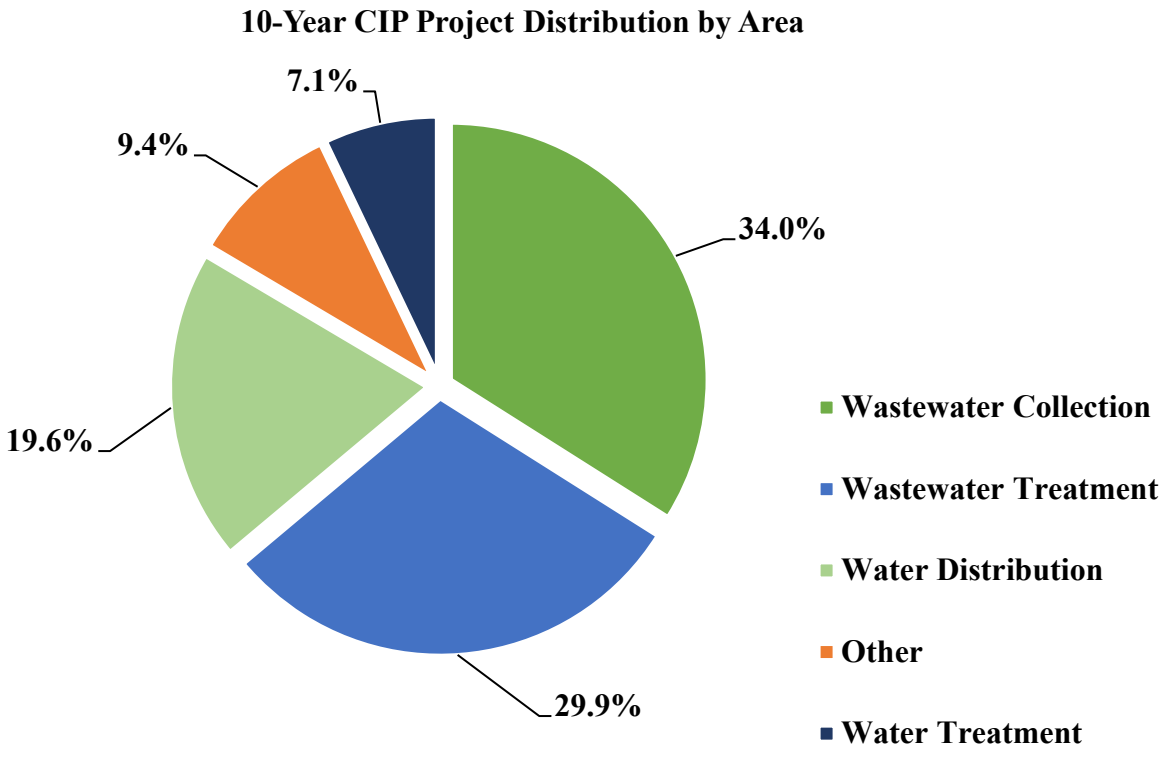
1) Projects that "Rehab or Replace Assets" are the majority of the capital budget in FY-2023. These projects generally increase the life of an existing asset or replace an existing asset which is at or beyond its expected life cycle.

2) "Enhancement" projects tend to improve efficiency by reducing long term costs or increase readiness.

3) "Expansion" projects add customers as growth.

10-Year CIP Distribution By Project Area

Project Area	Percent	Ten Year Investment	No. of Projects
Wastewater Collection	34.0%	$173,800,000	23
Wastewater Treatment	29.9%	$153,050,000	4
Water Distribution	19.6%	$100,300,000	19
Other	9.4%	$48,300,000	8
Water Treatment	7.1%	$36,250,000	8
Total	**100%**	**$511,700,000**	**62**



WATER: Projected 10 Year Capital Improvements Plan

Ref. #	FY-2023 to FY-2032 CIP	Funding Source	Current Project #	Amount Budgeted Prior to FY-23	Project Balance Feb 1, 2023	FY-23 to FY-32 Planned	FY-23 Planned	FY-24 Planned	FY-25 Planned	FY-26 Planned	FY-27 Planned	FY-28 Planned	FY-29 Planned	FY-30 Planned	FY-31 Planned	FY-32 Planned
	Water Capital Improvement Projects	*All dollar amounts are shown in 2023 dollars*														
Raw Water Improvements: Surface or Well Sources and Transmission																
138	Groundwater Well Rehabilitation (AMP)	1	20W009	$2,058,316	$224,373	$2,600,000	$600,000	$300,000	$300,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000
152	Kings Bluff Intake Canal Dredging and Rehabilitation	1	22W004	$600,000	$600,000	$850,000	$150,000	$0	$0	$0	$300,000	$0	$0	$0	$0	$400,000
159	Kings Bluff 30-inch Raw Water Main Condition Assessment	1		$0	$0	$200,000	$0	$0	$200,000	$0	$0	$0	$0	$0	$0	$0
96	Twin 24 Raw Water Transmission Mains	4	20W001	$8,100,000	$7,176,860	$4,200,000	$4,200,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Treatment Plant Improvements																
132	Sweeney WTP Filters 1-4 Rehabilitation Plus Media Exchange	1		$0	$0	$600,000	$0	$0	$0	$600,000	$0	$0	$0	$0	$0	$0
133	Sweeney Generators #1 and #2 Replacement	4		$0	$0	$8,000,000	$0	$0	$0	$8,000,000	$0	$0	$0	$0	$0	$0
122	Richardson WTP 3 MGD Expansion	2	16W210	$6,000,599	$3,350,809	$16,800,000	$0	$0	$0	$16,800,000	$0	$0	$0	$0	$0	$0
139	Richardson Concentrate Treatment	1	22W003	$400,000	$0	$3,000,000	$0	$3,000,000	$0	$0	$0	$0	$0	$0	$0	$0
Water Storage Improvements: Elevated, Ground and Aquifer Storage																
160	Porter's Neck Booster Pump Station Rehabilitation	1		$0	$0	$1,200,000	$200,000	$1,000,000	$0	$0	$0	$0	$0	$0	$0	$0
161	Elevated Tank SCADA Standardization Upgrades	1		$0	$0	$500,000	$500,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
157	Sweeney 4 MGD and 12 MGD Clearwell Rehab (AMP)	1		$0	$0	$1,000,000	$0	$500,000	$0	$0	$0	$0	$500,000	$0	$0	$0
53	Elevated Tank Rehabilitation and Coatings	1	18W002	$990,000	$237,090	$6,300,000	$850,000	$800,000	$500,000	$120,000	$270,000	$1,300,000	$840,000	$700,000	$470,000	$450,000
Distribution System Upgrades and Rehabilitation																
162	Chestnut and Grace Water Rehabilitation	4		$0	$0	$1,500,000	$1,500,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
150	Large Meter Replacement Program	1	21W008	$357,456	$243,620	$2,000,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000
134	Large Water Meter Vault Replacement	1	20W002	$1,088,455	$305,155	$3,000,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000
27	Water Main, Services and Valve Rehab/Replace (AMP)	4	17W244	$3,200,000	$33,342	$56,900,000	$2,300,000	$2,700,000	$5,200,000	$4,400,000	$6,400,000	$7,400,000	$6,900,000	$7,400,000	$7,100,000	$7,100,000
57	Water Emergency Repair	1	16W223	$933,845	$258,282	$2,500,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000
94	Water Distribution Main Enhancements	1	18W005	$650,000	$416,109	$600,000	$0	$300,000	$0	$300,000	$0	$0	$0	$0	$0	$0
153	Water System Master Plan	1	22W005	$100,000	$100,000	$600,000	$300,000	$0	$0	$0	$300,000	$0	$0	$0	$0	$0
Water Growth Projects																
163	River Road Booster Pump Station and Interconnections	1		$0	$0	$10,000,000	$1,000,000	$9,000,000	$0	$0	$0	$0	$0	$0	$0	$0
155	South Castle Hayne Road Water Main	1		$0	$0	$2,500,000	$250,000	$2,250,000	$0	$0	$0	$0	$0	$0	$0	$0
39	Distribution System - Standard Developer Agreements	1	17W248	$1,100,000	$492,561	$1,500,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
164	Richardson to Porters Neck Tank Water Main	1		$0	$0	$5,000,000	$0	$0	$0	$5,000,000	$0	$0	$0	$0	$0	$0
165	Gordon Road Interconnection with NCDOT	1		$0	$0	$1,000,000	$1,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
166	Lendire to Torchwood Interconnection	1		$0	$0	$1,200,000	$0	$0	$0	$1,200,000	$0	$0	$0	$0	$0	$0
167	Oakley Area Water Grant Application	8		$0	$0	$2,000,000	$200,000	$1,800,000	$0	$0	$0	$0	$0	$0	$0	$0
168	Alandale Area Water Grant Application	8		$0	$0	$1,000,000	$100,000	$900,000	$0	$0	$0	$0	$0	$0	$0	$0
Total Water Capital Improvement Projects					$13,438,201	$136,550,000	$14,050,000	$23,450,000	$7,100,000	$37,520,000	$8,370,000	$9,800,000	$9,340,000	$9,200,000	$8,670,000	$9,050,000
Total Wastewater Capital Improvement Projects					$6,066,155	$326,850,000	$16,900,000	$24,400,000	$150,950,000	$41,400,000	$12,550,000	$18,050,000	$19,650,000	$19,650,000	$11,650,000	$11,650,000
Total System Wide Capital Improvement Projects					$1,546,603	$48,300,000	$5,000,000	$4,800,000	$4,700,000	$4,800,000	$4,800,000	$4,900,000	$4,800,000	$4,900,000	$4,800,000	$4,800,000
Proposed Total Capital Improvement Projects					$21,050,959	$511,700,000	$35,950,000	$52,650,000	$162,750,000	$83,720,000	$25,720,000	$32,750,000	$33,790,000	$33,750,000	$25,120,000	$25,500,000

Funding Source																
1	Pay-go Transfers						$5,750,000	$18,050,000	$1,900,000	$8,320,000	$1,970,000	$2,400,000	$2,440,000	$1,800,000	$1,570,000	$1,950,000
2	Bond Proceeds						$0	$0	$0	$16,800,000	$0	$0	$0	$0	$0	$0
3	EPA Grants						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	SRF Loan Proceeds						$8,000,000	$2,700,000	$5,200,000	$12,400,000	$6,400,000	$7,400,000	$6,900,000	$7,400,000	$7,100,000	$7,100,000
5	Contributions from Others						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Capital Reserves						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	ARPA NC Set-Aside Grants ($30M)						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8	ARPA NC Grants for Septic to Sewer, if awarded						$300,000	$2,700,000	$0	$0	$0	$0	$0	$0	$0	$0
9	WIFIA (49%)/SRF 51%						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	TOTAL WATER					$136,550,000	$14,050,000	$23,450,000	$7,100,000	$37,520,000	$8,370,000	$9,800,000	$9,340,000	$9,200,000	$8,670,000	$9,050,000

Sum of All: Water, Waste Water and System Wide																
1	Pay-go Transfers						$15,850,000	$31,550,000	$7,250,000	$33,770,000	$12,720,000	$12,950,000	$12,890,000	$12,350,000	$12,020,000	$12,400,000
2	Bond Proceeds						$0	$0	$0	$16,800,000	$0	$0	$0	$0	$0	$0
3	EPA Grants						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	SRF Loan Proceeds						$18,500,000	$4,700,000	$8,500,000	$33,150,000	$13,000,000	$19,800,000	$20,900,000	$21,400,000	$13,100,000	$13,100,000
5	Contributions from Others						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Capital Reserves						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	ARPA NC Set-Aside Grants ($30M)						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8	ARPA NC Grants for Septic to Sewer, if awarded						$1,600,000	$13,400,000	$0	$0	$0	$0	$0	$0	$0	$0
9	WIFIA (49%)/SRF 51%						$0	$3,000,000	$147,000,000	$0	$0	$0	$0	$0	$0	$0
	TOTAL					$511,700,000	$35,950,000	$52,650,000	$162,750,000	$83,720,000	$25,720,000	$32,750,000	$33,790,000	$33,750,000	$25,120,000	$25,500,000

WASTE WATER: Projected 10 Year Capital Improvements Plan

Ref. #	FY-2023 to FY-2032 CIP	Funding Source	Current Project #	Amount Budgeted Prior to FY-23	Project Balance Feb 1, 2023	FY-23 to FY-32 Planned	FY-23 Planned	FY-24 Planned	FY-25 Planned	FY-26 Planned	FY-27 Planned	FY-28 Planned	FY-29 Planned	FY-30 Planned	FY-31 Planned	FY-32 Planned
	Wastewater Capital Improvement Projects	*All dollar amounts are shown in 2023 dollars*														
Waste Water Treatment Plant Improvements																
169	Southside WWTP - Copper Coagulant Chemical Feed System	1		$0	$0	$1,100,000	$150,000	$950,000	$0	$0	$0	$0	$0	$0	$0	$0
170	Northside WWTP - Interim Facility Improvements	1		$0	$0	$750,000	$750,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
131	Southside WWTP - Interim Rehabilitation Phase II	4	22S002	$1,750,000	$1,381,013	$1,200,000	$1,200,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
151	Southside WWTP - Capacity Upgrade (Design/Build)	9	09S016	$8,542,263	$0	$150,000,000	$0	$3,000,000	$147,000,000	$0	$0	$0	$0	$0	$0	$0
Collection System Rehabilitation/Replacement																
4	Find It, Fix It Methodology Sewer Collection Rehabilitation (AMP)	4	17S394	$18,200,000	$780,528	$38,000,000	$1,000,000	$1,000,000	$1,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000
171	Chestnut and Grace Sewer Rehabilitation	4		$0	$0	$1,500,000	$1,500,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
141	Motts Creek Outfall Rehabilitation	4		$0	$0	$7,710,000	$0	$0	$650,000	$7,060,000	$0	$0	$0	$0	$0	$0
142	Barnards Creek Outfall Rehabilitation	4		$0	$0	$8,340,000	$0	$0	$650,000	$7,690,000	$0	$0	$0	$0	$0	$0
172	Force Main Assessment Rehab/Replace (AMP)	1		$0	$0	$35,000,000	$0	$0	$0	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000
1	Sewer Emergency Repair	1	17S393	$16,500,000	$323,033	$5,000,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000
Pump Station & Force main Improvements																
154	Southern NHC Regional Pump Station	1	21S008	$3,891,631	$3,297,691	$1,850,000	$1,850,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
126	Pump Stations Prioritization and Rehabilitation	4	19S003	$1,321,000	$51,278	$10,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
143	PS-9 Walnut Street Pump Station Replacement	4	12S173	$3,900,068	$29,065	$4,500,000	$4,500,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
144	PS-12 Cowan Street Pump Station Rehab/Replace	4		$0	$0	$6,000,000	$0	$0	$0	$0	$600,000	$5,400,000	$0	$0	$0	$0
145	PS-14 Greenfield Lake FM Rehab/Replace	4	18S004	$11,842,985	$33,647	$1,300,000	$1,300,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
173	PS-34 NEI FM to Southside WWTP Rehabilitation	4		$0	$0	$8,000,000	$0	$0	$0	$0	$0	$1,000,000	$7,000,000	$0	$0	$0
174	PS-14 Rehabilitation	4		$0	$0	$9,000,000	$0	$0	$0	$0	$0	$0	$1,000,000	$8,000,000	$0	$0
175	PS-35 Force Main Redirect and Junction Box Rehabilitation	1		$0	$0	$1,200,000	$1,200,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sewer Growth Projects																
176	Motts Creek PS-69 Force Main Capacity Upgrade	1		$0	$0	$6,000,000	$0	$6,000,000	$0	$0	$0	$0	$0	$0	$0	$0
177	Wet Weather Model Development	1		$0	$0	$500,000	$500,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
146	Wastewater Master Plan	1	21S013	$300,000	$65,000	$300,000	$0	$0	$0	$0	$300,000	$0	$0	$0	$0	$0
156	PS-79 Bayshore 1 Capacity Expansion	1		$0	$0	$1,100,000	$0	$1,100,000	$0	$0	$0	$0	$0	$0	$0	$0
178	Oakley Area Septic to Sewer Grant Application	8		$0	$0	$10,000,000	$1,000,000	$9,000,000	$0	$0	$0	$0	$0	$0	$0	$0
179	Alandale Area Sewer Grant Application	8		$0	$0	$2,000,000	$300,000	$1,700,000	$0	$0	$0	$0	$0	$0	$0	$0
180	Kirkland PS-135 Capacity Upgrade	1		$0	$0	$5,000,000	$0	$0	$0	$5,000,000	$0	$0	$0	$0	$0	$0
181	Country Haven PS-95 Capacity Upgrade	1		$0	$0	$10,000,000	$0	$0	$0	$10,000,000	$0	$0	$0	$0	$0	$0
38	Collection System - Standard Developer Agreements	1	17S399	$1,100,000	$104,900	$1,500,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
Total Wastewater Capital Improvement Projects					$6,066,155	$326,850,000	$16,900,000	$24,400,000	$150,950,000	$41,400,000	$12,550,000	$18,050,000	$19,650,000	$19,650,000	$11,650,000	$11,650,000
Total Water Capital Improvement Projects					$13,438,201	$136,550,000	$14,050,000	$23,450,000	$7,100,000	$37,520,000	$8,370,000	$9,800,000	$9,340,000	$9,200,000	$8,670,000	$9,050,000
Total System Wide Capital Improvement Projects					$1,546,603	$48,300,000	$5,000,000	$4,800,000	$4,700,000	$4,800,000	$4,800,000	$4,900,000	$4,800,000	$4,900,000	$4,800,000	$4,800,000
Proposed Total Capital Improvement Projects					$21,050,959	$511,700,000	$35,950,000	$52,650,000	$162,750,000	$83,720,000	$25,720,000	$32,750,000	$33,790,000	$33,750,000	$25,120,000	$25,500,000
Funding Source																
1	Pay-go Transfers						$5,100,000	$8,700,000	$650,000	$20,650,000	$5,950,000	$5,650,000	$5,650,000	$5,650,000	$5,650,000	$5,650,000
2	Bond Proceeds						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	EPA Grants						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	SRF Loan Proceeds						$10,500,000	$2,000,000	$3,300,000	$20,750,000	$6,600,000	$12,400,000	$14,000,000	$14,000,000	$6,000,000	$6,000,000
5	Contributions from Others						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Capital Reserves						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	ARPA NC Set-Aside Grants ($30M)						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8	ARPA NC Grants for Septic to Sewer, if awarded						$1,300,000	$10,700,000	$0	$0	$0	$0	$0	$0	$0	$0
9	WIFIA (49%)/SRF 51%						$0	$3,000,000	$147,000,000	$0	$0	$0	$0	$0	$0	$0
	TOTAL WASTEWATER					$326,850,000	$16,900,000	$24,400,000	$150,950,000	$41,400,000	$12,550,000	$18,050,000	$19,650,000	$19,650,000	$11,650,000	$11,650,000

SYSTEM WIDE: Projected 10 Year Capital Improvements Plan

Ref. #	FY-2023 to FY-2032 CIP	Funding Source	Current Project #	Amount Budgeted Prior to FY-23	Project Balance Feb 1, 2023	FY-23 to FY-32 Planned	FY-23 Planned	FY-24 Planned	FY-25 Planned	FY-26 Planned	FY-27 Planned	FY-28 Planned	FY-29 Planned	FY-30 Planned	FY-31 Planned	FY-32 Planned
	System Wide Capital Improvement Projects	*All dollar amounts are shown in 2023 dollars*														
Systemwide projects for both Water and Wastewater																
34	Motor Fleet Capital	1	17A013	$4,326,197	$133,285	$9,300,000	$1,200,000	$900,000	$900,000	$900,000	$900,000	$900,000	$900,000	$900,000	$900,000	$900,000
40	OPS Large Equipment Purchases (Pumps, Plant Equipment, HVAC)	1	17A012	$3,851,307	$386,186	$10,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
114	IT SCADA & Security	1	19A001	$977,968	$505,434	$7,500,000	$750,000	$750,000	$750,000	$750,000	$750,000	$750,000	$750,000	$750,000	$750,000	$750,000
30	Information Technology Networking Infrastructure Replacement	1	16A007	$2,119,388	$17,995	$1,500,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
110	Generator Rehab and Replacement Program (AMP)	1	18A001	$690,500	$400,573	$5,000,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000
136	Facilities Structural and Roof Assessment and Rehab/Replace (AMP)	1	20A001	$160,000	$103,130	$4,600,000	$400,000	$400,000	$400,000	$400,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000
147	New Water and Sewer Service Installation	1		$0	$0	$400,000	$0	$100,000	$0	$100,000	$0	$100,000	$0	$100,000	$0	$0
182	Sustainability Program	1,3		$0	$0	$10,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Total System Wide Capital Improvement Projects					$1,546,603	$48,300,000	$5,000,000	$4,800,000	$4,700,000	$4,800,000	$4,800,000	$4,900,000	$4,800,000	$4,900,000	$4,800,000	$4,800,000
Total Water Capital Improvement Projects					$13,438,201	$136,550,000	$14,050,000	$23,450,000	$7,100,000	$37,520,000	$8,370,000	$9,800,000	$9,340,000	$9,200,000	$8,670,000	$9,050,000
Total Wastewater Capital Improvement Projects					$6,066,155	$326,850,000	$16,900,000	$24,400,000	$150,950,000	$41,400,000	$12,550,000	$18,050,000	$19,650,000	$19,650,000	$11,650,000	$11,650,000
Proposed Total Capital Improvement Projects					$21,050,959	$511,700,000	$35,950,000	$52,650,000	$162,750,000	$83,720,000	$25,720,000	$32,750,000	$33,790,000	$33,750,000	$25,120,000	$25,500,000

Funding Source																
1	Pay-go Transfers						$5,000,000	$4,800,000	$4,700,000	$4,800,000	$4,800,000	$4,900,000	$4,800,000	$4,900,000	$4,800,000	$4,800,000
2	Bond Proceeds						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	EPA Grants						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	SRF Loan Proceeds						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	Contributions from Others						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	Capital Reserves						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	ARPA NC Set-Aside Grants ($30M)						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8	ARPA NC Grants for Septic to Sewer, if awarded						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9	WIFIA (49%)/SRF 51%						$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	TOTAL SYSTEM WIDE					$48,300,000	$5,000,000	$4,800,000	$4,700,000	$4,800,000	$4,800,000	$4,900,000	$4,800,000	$4,900,000	$4,800,000	$4,800,000

Ten Year CIP Highest to Lowest Planned Project Cost Sort

Reference Number	FY-2023 to FY-2032 CIP	Ten Year Total	Percentage of Total Budget	Running Cumulative Total Budget Percentage	Project Type	Project Area
151	Southside WWTP - Capacity Upgrade (Design/Build)	$150,000,000	29.31%	29.31%	Expansion	Wastewater Treatment
27	Water Main, Services and Valve Rehab/Replace (AMP)	$56,900,000	11.12%	40.43%	Rehab or Replace Assets	Water Distribution
4	Find It, Fix It Methodology Sewer Collection Rehabilitation (AMP)	$38,000,000	7.43%	47.86%	Rehab or Replace Assets	Wastewater Collection
172	Force Main Assessment Rehab/Replace (AMP)	$35,000,000	6.84%	54.70%	Rehab or Replace Assets	Wastewater Collection
122	Richardson WTP 3 MGD Expansion	$16,800,000	3.28%	57.98%	Expansion	Water Treatment
181	Country Haven PS-95 Capacity Upgrade	$10,000,000	1.95%	59.94%	Expansion	Wastewater Collection
182	Sustainability Program	$10,000,000	1.95%	61.89%	Enhancement	Other
178	Oakley Area Septic to Sewer Grant Application	$10,000,000	1.95%	63.85%	Expansion	Wastewater Collection
126	Pump Stations Prioritization and Rehabilitation	$10,000,000	1.95%	65.80%	Rehab or Replace Assets	Wastewater Collection
40	OPS Large Equipment Purchases (Pumps, Plant Equipment, HVAC)	$10,000,000	1.95%	67.75%	Rehab or Replace Assets	Other
163	River Road Booster Pump Station and Interconnections	$10,000,000	1.95%	69.71%	Expansion	Water Distribution
34	Motor Fleet Capital	$9,300,000	1.82%	71.53%	Rehab or Replace Assets	Other
174	PS-14 Rehabilitation	$9,000,000	1.76%	73.29%	Rehab or Replace Assets	Wastewater Collection
142	Barnards Creek Outfall Rehabilitation	$8,340,000	1.63%	74.91%	Rehab or Replace Assets	Wastewater Collection
133	Sweeney Generators #1 and #2 Replacement	$8,000,000	1.56%	76.48%	Rehab or Replace Assets	Water Treatment
173	PS-34 NEI FM to Southside WWTP Rehabilitation	$8,000,000	1.56%	78.04%	Rehab or Replace Assets	Wastewater Collection
141	Motts Creek Outfall Rehabilitation	$7,710,000	1.51%	79.55%	Rehab or Replace Assets	Wastewater Collection
114	IT SCADA and Security	$7,500,000	1.47%	81.01%	Rehab or Replace Assets	Other
53	Elevated Tank Rehabilitation and Coatings	$6,300,000	1.23%	82.25%	Rehab or Replace Assets	Water Distribution
176	Motts Creek PS-69 Force Main Capacity Upgrade	$6,000,000	1.17%	83.42%	Expansion	Wastewater Collection
144	PS-12 Cowan Street Pump Station Rehab/Replace	$6,000,000	1.17%	84.59%	Rehab or Replace Assets	Wastewater Collection
1	Sewer Emergency Repair	$5,000,000	0.98%	85.57%	Rehab or Replace Assets	Wastewater Collection
164	Richardson to Porters Neck Tank Water Main	$5,000,000	0.98%	86.54%	Expansion	Water Distribution
180	Kirkland PS-135 Capacity Upgrade	$5,000,000	0.98%	87.52%	Expansion	Wastewater Collection
110	Generator Rehab and Replacement Program (AMP)	$5,000,000	0.98%	88.50%	Rehab or Replace Assets	Other

Reference Number	FY-2023 to FY-2032 CIP	Ten Year Total	Percentage of Total Budget	Running Cumulative Total Budget Percentage	Project Type	Project Area
136	Facilities Structural and Roof Assessment and Rehab/Replace (AMP)	$4,600,000	0.90%	89.40%	Rehab or Replace Assets	Other
143	PS-9 Walnut Street Pump Station Replacement	$4,500,000	0.88%	90.28%	Rehab or Replace Assets	Wastewater Collection
96	Twin 24 Raw Water Transmisson Mains	$4,200,000	0.82%	91.10%	Rehab or Replace Assets	Water Treatment
139	Richardson Concentrate Treatment	$3,000,000	0.59%	91.68%	Enhancement	Water Treatment
134	Large Water Meter Vault Replacement	$3,000,000	0.59%	92.27%	Rehab or Replace Assets	Water Distribution
138	Groundwater Well Rehabilitation (AMP)	$2,600,000	0.51%	92.78%	Rehab or Replace Assets	Water Treatment
155	South Castle Hayne Road Water Main	$2,500,000	0.49%	93.27%	Expansion	Water Distribution
57	Water Emergency Repair	$2,500,000	0.49%	93.76%	Rehab or Replace Assets	Water Distribution
150	Large Meter Replacement Program	$2,000,000	0.39%	94.15%	Rehab or Replace Assets	Water Distribution
179	Alandale Area Sewer Grant Application	$2,000,000	0.39%	94.54%	Expansion	Wastewater Collection
167	Oakley Area Water Grant Application	$2,000,000	0.39%	94.93%	Expansion	Water Distribution
154	Southern NHC Regional Pump Station	$1,850,000	0.36%	95.29%	Expansion	Wastewater Collection
162	Chestnut and Grace Water Rehabilitation	$1,500,000	0.29%	95.58%	Rehab or Replace Assets	Water Distribution
30	Information Technology Networking Infrastructure Replacement	$1,500,000	0.29%	95.88%	Rehab or Replace Assets	Other
38	Collection System - Standard Developer Agreements	$1,500,000	0.29%	96.17%	Expansion	Wastewater Collection
39	Distribution System - Standard Developer Agreements	$1,500,000	0.29%	96.46%	Expansion	Water Distribution
171	Chestnut and Grace Sewer Rehabilitation	$1,500,000	0.29%	96.76%	Rehab or Replace Assets	Wastewater Treatment
145	PS-14 Greenfield Lake FM Rehab/Replace	$1,300,000	0.25%	97.01%	Rehab or Replace Assets	Wastewater Collection
175	PS-35 Force Main Redirect and Junction Box Rehabilitation	$1,200,000	0.23%	97.24%	Rehab or Replace Assets	Wastewater Collection
166	Lendire to Torchwood Interconnection	$1,200,000	0.23%	97.48%	Expansion	Water Distribution
160	Porter's Neck Booster Pump Station Rehabilitation	$1,200,000	0.23%	97.71%	Rehab or Replace Assets	Water Distribution
131	Southside WWTP - Interim Rehabilitation Phase II	$1,200,000	0.23%	97.95%	Rehab or Replace Assets	Wastewater Treatment
156	PS-79 Bayshore 1 Capacity Expansion	$1,100,000	0.21%	98.16%	Expansion	Water Distribution
169	Southside WWTP - Copper Coagulant Chemical Feed System	$1,100,000	0.21%	98.38%	Enhancement	Wastewater Treatment
168	Alandale Area Water Grant Application	$1,000,000	0.20%	98.57%	Expansion	Water Distribution
165	Gordon Road Interconnection with NCDOT	$1,000,000	0.20%	98.77%	Expansion	Water Distribution
157	Sweeney 4 MGD and 12 MGD Clearwell Rehab (AMP)	$1,000,000	0.20%	98.96%	Rehab or Replace Assets	Water Treatment

Reference Number	FY-2023 to FY-2032 CIP	Ten Year Total	Percentage of Total Budget	Running Cumulative Total Budget Percentage	Project Type	Project Area
152	Kings Bluff Intake Canal Dredging and Rehabilitation	$850,000	0.17%	99.13%	Rehab or Replace Assets	Water Treatment
170	Northside WWTP - Interim Facility Improvements	$750,000	0.15%	99.28%	Rehab or Replace Assets	Wastewater Treatment
94	Water Distribution Main Enhancements	$600,000	0.12%	99.39%	Enhancement	Water Distribution
132	Sweeney WTP Filters 1-4 Rehabilitation	$600,000	0.12%	99.51%	Rehab or Replace Assets	Water Treatment
153	Water System Master Plan	$600,000	0.12%	99.63%	Expansion	Water Distribution
161	Elevated Tank SCADA Standardization Upgrades	$500,000	0.10%	99.73%	Enhancement	Water Distribution
177	Wet Weather Model Development	$500,000	0.10%	99.82%	Enhancement	Wastewater Collection
147	New Water and Sewer Service Installation	$400,000	0.08%	99.90%	Expansion	Other
146	Wastewater Master Plan	$300,000	0.06%	99.96%	Expansion	Wastewater Collection
159	Kings Bluff 30-inch Raw Water Main Condition Assessment	$200,000	0.04%	100.00%	Rehab or Replace Assets	Water Treatment
Total		**$511,700,000**				

*These growth projects will have substantial capital cost recovery from new customers or other stakeholders. The entire project amount is programmed to allow construction prior to cost recovery.

Appendix H

New Hanover County 2023-2050 Population Projection by Age

County	Year	Total
New Hanover	2023	239,395
New Hanover	2024	242,708
New Hanover	2025	246,018
New Hanover	2026	249,330
New Hanover	2027	252,640
New Hanover	2028	255,953
New Hanover	2029	259,265
New Hanover	2030	262,576
New Hanover	2031	265,889
New Hanover	2032	269,198
New Hanover	2033	272,511
New Hanover	2034	275,822
New Hanover	2035	279,133
New Hanover	2036	282,445
New Hanover	2037	285,756
New Hanover	2038	289,068
New Hanover	2039	292,380
New Hanover	2040	295,691
New Hanover	2041	299,002
New Hanover	2042	302,313
New Hanover	2043	305,624
New Hanover	2044	308,937
New Hanover	2045	312,248
New Hanover	2046	315,559
New Hanover	2047	318,871
New Hanover	2048	322,184
New Hanover	2049	325,494
New Hanover	2050	328,806

Appendix I

City of Wilmington Land Development Code
Article 13. Floodplain Management

ARTICLE 13. - FLOODPLAIN MANAGEMENT

DIVISION 1. - GENERAL PROVISIONS

Sec. 18-636. - Title.

This article shall be known as the Floodplain Management Regulations of the City of Wilmington, North Carolina, and may be referred to as the Flood Damage Prevention Ordinance.

(Ord. No. O-2018-46, § 1, 7-17-18)

Sec. 18-637. - Purpose.

The purpose of this article is to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions within flood prone areas by provisions designed to:

(1) Restrict or prohibit uses which are dangerous to the health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;

(2) Require the uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

(3) Control the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of flood waters;

(4) Control filling, grading, dredging and other development which may increase erosion or flood damage; and

(5) Prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands.

The flood prone areas within the jurisdiction of City of Wilmington are subject to periodic inundation that may result in loss of life, property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures of flood protection and relief, and impairment of the tax base, all of which may adversely affect the public health, safety, and general welfare. These flood losses are caused by the cumulative effect of obstructions in floodplains causing increases in flood heights and velocities and by the occupancy in flood prone areas of uses vulnerable to floods or other hazards.

The objectives of this article are to: protect human life, safety, and health; minimize expenditure of public money for costly flood control projects; minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public; minimize prolonged business losses and interruptions; minimize damage to public facilities and utilities (i.e., water and gas mains, electric, telephone, cable and sewer lines, streets, and bridges) that are located in flood prone areas; minimize

damage to private and public property due to flooding; make flood insurance available to the community through the National Flood Insurance Program; maintain the natural and beneficial functions of the floodplain; help maintain a stable tax base by providing for the sound use and development of flood prone areas; and ensure that potential buyers are aware that property is in a special flood hazard area.

(Ord. No. O-2006-26, § 1(a), 3-7-06; Ord. No. O-2018-46, § 2, 7-17-18)

Sec. 18-638. - Scope; full compliance required.

This article shall apply to all areas of special flood hazard lying within the regulatory jurisdiction of the city.

Secs. 18-639—18-643. - Reserved.

DIVISION 2. - ADMINISTRATION, ENFORCEMENT

Sec. 18-644. - Generally.

No structure or land shall hereafter be located, extended, converted, altered, or developed in any way without full compliance with the terms of this ordinance and other applicable regulations.

(Ord. No. O-2018-46, § 3, 7-17-18)

Sec. 18-645. - Basis for establishing the special flood hazard areas and future conditions flood hazard areas.

The special flood hazard areas are those identified-under the cooperating technical state agreement between the State of North Carolina and FEMA in its flood insurance study dated August 28, 2018 for New Hanover County and its associated DFIRM panels, including any digital data developed as part of the flood insurance study, which are adopted by reference and declared to be a part of this ordinance. Future revisions to the flood insurance study and DFIRM panels that do not change flood hazard data within the jurisdictional authority of the City of Wilmington are also adopted by reference and declared a part of this ordinance. Subsequent letters of map revision (LOMRs) and/or physical map revisions shall be adopted within three (3) months.

(Ord. No. O-2006-26, § 1(b), 3-7-06; Ord. No. O-2008-25, 4-8-08; Ord. No. O-2018-46, § 4, 7-17-18)

Sec. 18-646. - Application for development permits; certification required.

(a) Except as provided in subsection 18-661(b), no person may start any floodplain development activities within areas of special flood hazard without having first obtained a floodplain development permit from the floodplain administrator in accordance with this article. Approval

for commencement of development will be given as follows:

(1) Residential and nonresidential structures:

a. The floodplain administrator shall approve or disapprove proposed development as to compliance with this article at the same time he approves the issuance of a building permit for any new construction, improvements, reconstruction or alterations for buildings, dwellings or structures.

b. The floodplain administrator shall approve the issuance of a building permit if the plans for the development meet the following criteria:

i. The proposed structure is within a flood prone area as designated by the herein referenced maps and complies with the standards of this article; or

ii. The proposed structure is not within a flood prone area as designated by the herein referenced maps and is exempted from the standards of this article.

(2) Development other than structures: The floodplain administrator shall certify all construction, improvements or reconstruction not otherwise authorized by the building permit, provided such development conforms with the requirements of this article.

(3) Before giving clearance to any proposed artificial obstruction in areas of special flood hazard, the floodplain administrator shall also consider the dangers that may be created by:

a. Water which may be backed up or diverted by such obstruction;

b. The possibility that the obstruction will be swept downstream to the injury of others;

c. The injury or damage at the site of the obstruction itself; and

d. Potential adverse effects on existing and anticipated development.

(b) Application for a floodplain development permit shall be made to the local floodplain administrator on forms furnished by him or her prior to any development activities. The floodplain development permit may include but not be limited to plans drawn to scale showing the nature, location, dimensions, and elevations of the area of development/disturbance; existing and proposed structures, utility systems, grading/pavement areas; and the location of fill materials, storage areas, drainage facilities, and other development. Specifically, the following information is required:

(1) Where base flood elevation data is provided by FEMA, the application for a floodplain development permit within the special flood hazard areas designated on the flood insurance rate map shall show:

a. The boundary of the special flood hazard area as delineated on the FIRM or other flood map as determined in Article 13, Division II, or a statement that the entire lot is within the special flood hazard area.

b.

Flood zone(s) designation of the proposed development area as determined on the FIRM or other flood map;

c. The boundary of the floodway(s) or non-encroachment area(s);

d. The base flood elevation (BFE);

e. The old and new location of any watercourse that will be altered or relocated as a result of proposed development;

f. The boundary and designation date of the Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA), if applicable; and

g. The certification of the plot plan by a registered land surveyor or professional engineer.

h. The proposed elevation, and method thereof, of all development within a special flood hazard area including but not limited to:

i. The elevation in relation to NAVD 1988 of the lowest floor, including the basement, of all new and substantially improved structures; and

ii. If the structure has been flood-proofed in accordance with this article, the elevation in relation to NAVD 1988 to which the non-residential structure was flood-proofed; and the

iii. Elevation in relation to NAVD 1988 to which any proposed utility systems will be elevated or floodproofed.

(2) If floodproofing pursuant to section 18-660, a floodproofing certificate (FEMA Form 086-0-34) with supporting data, an operational plan, and an inspection maintenance plan that include, but are not limited to, installation, exercise, and maintenance of floodproofing measures. Prior to the issuance of a certificate of compliance/occupancy, the permit holder shall submit to the floodplain administrator a certification of the floodproofed design prepared by or under the direct supervision of a professional engineer or architect and certified by same. The floodplain administrator shall review the certificate data, the operational plan, and the inspection and maintenance plan. Deficiencies detected by such review shall be corrected by the applicant. Failure to construct in accordance with the certified design shall be cause to deny a certificate of occupancy/compliance.

(3) Where the base flood elevation data is not provided, the application for a floodplain development permit must show construction of the lowest floor at least two (2) feet above the highest adjacent grade.

(4) A description of the extent to which any watercourse will be altered or relocated as a result of proposed development; and engineering report on the effects of the proposed project on the flood carrying capacity of the watercourse and on properties located both upstream and downstream; and a map showing the location of the proposed watercourse alteration or

relocation.

(5) A certificate from a registered professional engineer or licensed architect that utilities have been or will be located, designed and constructed to eliminate flood damage. In the case of sanitary sewer systems and on-site waste disposal systems, this certificate shall provide that such systems have been or will be located, designed or constructed to eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters.

(6) A foundation plan, drawn to scale, which shall include details of the proposed foundation system to ensure all provisions of this ordinance are met. The details include but are not limited to:

a. The proposed method of elevation, if applicable (i.e., fill, solid foundation perimeter wall, solid backfilled foundation, open foundation on columns/posts/piers/piles/shear walls); and

b. Openings to facilitate the automatic equalization of hydrostatic flood forces on walls when solid foundation perimeter walls are used in Zones A, AE, AH, AO, and A99.

c. The following, in coastal high hazard areas, in accordance with the provisions of section 18-660:

i. V-Zone Certification with accompanying plans and specifications verifying the engineered structure and any breakaway wall designs. In addition, prior to the certificate of compliance/occupancy issuance, a registered professional engineer or architect shall certify the finished construction is compliant with the design, specifications, and plans for VE zone construction.

ii. Plans for open wood latticework or insect screening, if applicable; and

iii. Plans for non-structural fill, if applicable. If nonstructural fill is proposed, it must be demonstrated through coastal engineering analysis that the proposed fill would not result in any increase in the BFE or otherwise cause adverse impacts by wave ramping and deflection on to the subject structure or adjacent properties.

(7) Details on the proposed use of any enclosed areas below the finished floor.

(8) Certification that all other local, state, and federal permits required prior to floodplain development permit issuance have been received.

(c) After the lowest floor is completed, the holder of the floodplain development permit must obtain a floor elevation or flood-proofing certificate prepared by a registered professional engineer or licensed architect. The certification shall show the elevation of the lowest floor or flood-proofed elevation in relation to the regulatory flood protection elevation. Such certification shall be submitted to the floodplain administrator within twenty-one (21) calendar days after the lowest floor elevation is established or the structure is flood-proofed, whichever is applicable. The floodplain administrator shall review the floor elevation of flood-proofing certification. The permit

holder shall correct any floor elevation or flood-proofing deficiencies detected by the floodplain administrator before further work is done. Failure to submit the required certification within the above time limit or failure to correct any deficiencies identified by the floodplain administrator shall be cause to issue a stop work order pursuant to section 18-648 of this article.

(d) A final finished construction elevation certificate is required after construction is completed and prior to the final city zoning inspection. It shall be the duty of the permit holder to submit to the floodplain administrator a certification of final as-built construction of the elevation of the reference level and all attendant utilities. The floodplain administrator shall review the certificate data submitted. Deficiencies detected by such review shall be corrected by the permit holder immediately and prior to certificate of compliance/occupancy issuance. In some instances, another certification may be required to certify corrected as-built construction. Failure to submit the certification or failure to make required corrections shall be cause to withhold issuance of a certificate of compliance/occupancy. The finished construction elevation certificate shall provide at least two (2) photographs showing the front and rear of the building taken within ninety (90) days from the date of certification. The photographs must be taken with views confirming the building description and diagram number provided in Section A of FEMA Form 086-0-33. To the extent possible, these photographs should show the entire building, including foundation. If the building has split-level or multi-level areas, provide at least two (2) additional photographs showing side views of the building. In addition, when applicable, provide a photograph of the foundation showing a representative example of the flood openings or vents. All photographs must be in color and measure at least three (3) inches by three (3) inches. Digital photographs are acceptable.

(e) For applications for building permits to improve buildings and structures, including alterations, movement, enlargement, replacement, repair, change of occupancy, additions, rehabilitations, renovations, substantial improvements, repairs of substantial damage, and any other improvement of or work on buildings and structures, the floodplain administrator, in coordination with the building official, shall:

(1) Estimate the market value, or require the applicant to obtain an appraisal of the market value prepared by a qualified independent appraiser, of the building or structure before the start of construction of the proposed work; in the case or repair, the market value of the building or structure shall be the market value before the damage occurred and before any repairs are made;

(2) Compare the cost to perform the improvement, the cost to repair a damaged building to its pre-damaged condition, or the combined costs of improvements and repairs, if applicable, to the market value of the building or structure;

(3) Determine and document whether the proposed work constitutes substantial improvement or repair of substantial damage; and

(4) Notify the applicant if it is determined that the work constitutes substantial improvement or repair of substantial damage and that compliance with the flood resistant construction requirements of the North Carolina State Building Code and this ordinance is required.

(Ord. No. O-2018-46, § 5, 7-17-18)

Sec. 18-647. - Duties and responsibilities of floodplain administrator.

(a) The duties of the floodplain administrator under this article shall include, but not be limited to:

(1) Reviewing all floodplain development permits to assure that the requirements of this article have been satisfied.

(2) Approving or denying clearance for building permits and construction projects as provided in section 18-646.

(3) Reviewing all proposed development within special flood hazard areas to assure that all necessary local, state, and federal permits have been received, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972.

(4) Notifying adjacent communities, if applicable, and the North Carolina Department of Crime Control and Public Safety, Division of Emergency Management, state coordinator for the National Flood Insurance Program before any alteration or relocation of a watercourse, and submitting evidence of such notification to the Federal Emergency Management Agency.

(5) Preventing encroachments within areas of special flood hazard unless the certification and flood hazard reduction provisions of this article are met.

(6) Assuring that maintenance is provided within any altered or relocated portion of a watercourse so that the flood-carrying capacity is not diminished.

(7) Verifying and recording the actual elevation in relation to NAVD 1988 of the lowest floor, including basement, of all new or substantially improved structures within or adjacent to flood prone areas.

(8) Verifying and recording the actual elevation in relation to NAVD 1988 to which new or substantially improved structures have been flood-proofed.

(9) Obtaining certification from a registered professional engineer or licensed architect that water supply systems and sanitary sewers or on-site waste disposal systems are located designed and constructed to eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters.

(10) When flood-proofing is utilized for a particular structure, obtaining certification from a registered professional engineer or licensed architect, pursuant to section 18-660.

(11) When the lowest floor and the lowest adjacent grade of a structure or the lowest ground elevation of a parcel in a special flood hazard area is above the base flood elevation, advise the property owner of the option to apply for a letter of map amendment (LOMA) from FEMA.

A copy of the letter of map amendment issued from FEMA will be maintained by the floodplain administrator in the permit file.

(12) Make on-site inspections of projects in accordance with section 18-648.

(13) Serve notices of violations, issued stop-work orders, revoke permits, and take corrective actions in accordance with section 18-648.

(b) Where interpretation is needed as to the exact location of the boundaries of the areas of special flood hazard (for example, where there appears to be a conflict between a mapped boundary and actual field conditions), the floodplain administrator shall make the necessary interpretation. The person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation as provided in this article.

(c) When base flood elevation data or floodway data has not been provided by FEMA, the floodplain administrator shall obtain, review and reasonably utilize any base flood elevation data and floodway data available from a federal, state or other source, in order to administer the provisions of this article.

(d) The floodplain administrator shall permanently maintain all records pertaining to the provisions of this article, including all maps designating flood-prone areas and annual reports filed with the Federal Emergency Management Agency. These records shall be open for public inspection, recognizing that such information may be subject to the Privacy Act of 1974, as amended.

(e) The floodplain administrator shall review, provide input on, and report all variances granted from this article to the Federal Emergency Management Agency.

(f) Make periodic inspections throughout the special flood hazard areas within the jurisdiction of the community. The floodplain administrator and each member of his or her inspections department shall have a right, upon presentation of proper credentials, to enter on any premises within the territorial jurisdiction of the department at any reasonable hour for the purposes of inspection or other enforcement action.

(Ord. No. O-2018-46, §§ 6—14, 7-17-18)

Sec. 18-648. - Administrative procedures.

(a) As the work pursuant to a permit progresses, the floodplain administrator shall make as many inspections of the work as may be necessary to ensure that the work is being done according to the provisions of the local ordinance and the terms of the permit. In exercising this power, the floodplain administrator has a right, upon presentation of proper credentials, to enter on any premises within the territorial jurisdiction at any reasonable hour for the purposes of inspection or other enforcement action.

(b)

Whenever a building or part thereof is being constructed, reconstructed, altered, or repaired in violation of this chapter, the floodplain administrator may order the work to be immediately stopped. The stop-work order shall be in writing and directed to the person doing the work. The stop-work order shall state the specific work to be stopped, the specific reasons for the stoppage, and the conditions under which the work may be resumed. Violation of a stop-work order constitutes a misdemeanor.

(c) The floodplain administrator may revoke and require the return of the floodplain development permit by notifying the permit holder in writing stating the reason for the revocation. Permits shall be revoked for any substantial departure from the approved application, plans, or specifications; for refusal or failure to comply with the requirements of state or local laws; or for false statements or misrepresentations made in securing the permit. Any permit mistakenly issued in violation of an applicable state or local law may also be revoked.

(d) When the floodplain administrator finds violations of applicable state and local laws, it shall be his duty to notify the owner or occupant of the building of the violation. The owner or occupant shall immediately remedy each of the violations of law in the property he owns.

(e) If the owner of a building or property shall fail to take prompt corrective action, the floodplain administrator shall give him written notice, by certified or registered mail to his last known address or by personal service, of the determination that the building or property is in violation of the Floodplain Management Regulations and requiring the owner to remedy the violation within such period, not less than sixty (60) days, as the administrator may prescribe; provided that where the administrator finds that there is imminent danger to life or other property, he may order that corrective action be taken in such lesser period as may be feasible.

(f) Any owner who has received such determination and notice to take corrective action may appeal from the notice to the board of adjustment by giving notice of appeal in writing to the floodplain administrator within thirty (30) days following the written notice. In the absence of an appeal, the floodplain administrator's determination shall be final. The board of adjustment shall hear an appeal within a reasonable time and may affirm, modify and affirm, or revoke the determination of the floodplain administrator. Any person aggrieved by the decision of the board of adjustment may appeal such decision to the superior court within thirty (30) days of the signing of the order of the board. Such appeal shall be in the nature of certiorari.

(g) Violation of the provisions of this article or failure to comply with any of its requirements, including violation of conditions and safeguards established in connection with grants of variance, special exceptions, or other order of the governing body, or failure to comply with an order to take corrective action for which no appeal has been made, shall constitute a Class 1 misdemeanor pursuant to G.S. § 143-215.58. Punishment shall include a fine of not more than one hundred dollars ($100.00) per day or imprisonment for not more than thirty (30) days, or

both. Each day such a violation continues shall be considered a separate offense. Nothing herein contained shall prevent the city from taking such other lawful action as is necessary to prevent or remedy any violation.

(Ord. No. O-2018-46, §§ 15—21, 7-17-18)

Sec. 18-649. - Variance procedures.

(a) The board of adjustment shall hear and decide requests for variances from the requirements of this article. The board shall provide appropriate forms and information to person applying for a variance to enable them to furnish all necessary information to the board. The variance request shall be written and shall include information as to all of the factors set forth in subsection (b) and any other pertinent information.

(b) In passing upon such applications, the board of adjustment shall consider all technical evaluations, all relevant factors, standards specified in other sections of this section, and the following factors:

(1) The danger that materials may be swept onto other lands to the injury of others;

(2) The danger to life and property due to flooding;

(3) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;

(4) The importance of the services provided by the proposed facility to the community;

(5) The necessity to the facility of a waterfront location, where applicable;

(6) The availability of alternative locations, not subject to flood damage, for the proposed use;

(7) The compatibility of the proposed use with existing and anticipated development;

(8) The relationship of the proposed use to the Comprehensive Plan and Floodplain Management Program for that area;

(9) The safety of access to the property in times of flood for ordinary and emergency vehicles;

(10) The expected heights, velocity, duration, rate of rise and sediment transport of the flood waters and the effects of wave action, if applicable, expected at the site; and

(11) The costs of providing governmental services during and after flood conditions including maintenance and repair of public utilities and facilities such as sewer, gas, electrical and water systems, and streets and bridges.

(c) Generally, variances may be issued for new construction and substantial improvements to be erected on lots of one-half (½) acre or less in size, contiguous to and surrounded by lots with an existing structure constructed below the base flood level, providing the factors set forth in subsection 18-649(b) above have been fully considered. As the lot size increases beyond one-half (½) acre, the technical justification required for issuing the variance increases.

(d) Upon consideration of the factors listed above and the purposes of this article, the board of adjustment may attach such conditions to the granting of variances as it deems necessary to further the purposes of this article.

(e) Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

(f) Variances may be issued for:

(1) The reconstruction, rehabilitation, or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places upon the determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and that the variance is the minimum necessary to preserve the historic character and design of the structure.

(2) Water dependent facilities if determined to meet the definition as defined in this chapter, provided variances within the floodway will not increase flood levels during the base flood discharge, the requested variance is the minimum necessary to afford relief, such facilities are protected by methods that minimize flood damages during the base flood and create no additional threat to public safety.

(3) Any other type of development provided it meets the requirements of this section.

(g) Conditions for variances:

(1) Variances may not be issued when the variance will make the structure in violation of other federal, state, or local laws, regulations, or ordinances.

(2) Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.

(3) Variances shall only be issued upon a showing of good and sufficient cause, a determination that failure to grant the variance would result in exceptional hardship to the applicant, and, a determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances.

(4) Any applicant to whom a variance is granted shall be given written notice specifying the difference between the base flood elevation and the elevation to which the structure is to be built and stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest flood elevation. Such notification shall be maintained with a record of all variance actions.

(5) The floodplain administrator shall maintain the records of all appeal actions and report any variances to the Federal Insurance Administration upon request.

(6)

No variance shall be approved for any new solid waste disposal facilities, hazardous waste management facilities, salvage yards, and chemical storage facilities in the 100-year floodplain except in accordance with the following standards: Provided that a structure or tank for chemical or fuel storage incidental to a use that is allowed under this section or to the operation of a water treatment plant or wastewater treatment facility may be located in a 100-year floodplain only if the structure or tank is either elevated above base flood elevation or designed to be watertight with walls substantially impermeable to the passage of water and with structural components capable of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy. The city must notify the Secretary of the North Carolina Department of Public Safety of its intention to grant a variance at least thirty (30) calendar days prior to granting the variance.

(Ord. No. O-2018-46, §§ 22—25, 7-17-18)

Secs. 18-650—18-658. - Reserved.

DIVISION 3. - FLOODPLAIN MANAGEMENT STANDARDS

Sec. 18-659. - General standards.

(a) The following requirements shall apply in all special flood hazard areas:

(1) All new construction and substantial improvements shall be:

a. Designed or modified and anchored to prevent flotation, collapse or lateral movement of the structure;

b. Constructed with materials and utility equipment resistant to flood damage in accordance with the FEMA Technical Bulletin 2, *Flood Damage Resistant Materials Requirements,* including any subsequent updates to that Technical Bulletin; and

c. Constructed by methods and practices that minimize flood damage.

(2) All new and replacement water supply systems shall be designed to eliminate infiltration of flood waters into the system.

(3) All new and replacement sanitary sewage systems shall be designed to eliminate infiltration of flood waters into the system and discharges from the system into flood waters.

(4) All new and replacement on-site waste disposal systems shall be reasonably located, designed, and constructed to avoid impairment to them or contamination from them during flooding.

(5) Electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities shall be located at or above the regulatory flood protection elevation or designed and installed so as to prevent water from entering or accumulating within the components during flooding. These include but are not limited to HVAC equipment, water softener units,

bath/kitchen fixtures, ductwork, electric/gas meter panels/boxes, utility/cable boxes, appliances (washers, dryers, refrigerators, freezers, etc.), hot water heaters, and electric outlets/switches.

(b) When a structure is partially located in a special flood hazard area, the entire structure shall meet the requirements for new construction and substantial improvement. When a structure is located in multiple flood hazard zones or in a flood hazard risk zone with multiple base flood elevations, the more restrictive requirements shall apply.

(c) Nonconforming buildings or uses may not be enlarged, replaced, or rebuilt unless such enlargement or reconstruction is accomplished in conformance with the provisions of this article. However, nothing in this article shall prevent the repair, reconstruction, or replacement of a building or structure existing on the effective date of this article and located totally or partially within the areas of special flood hazard, provided that the bulk of the building or structure below base flood elevation in an area of special flood hazard is not increased and provided that such repair, reconstruction, or replacement meets all of the other requirements of this article.

(Ord. No. O-2006-26, § 1(c), 3-7-06; Ord. No. O-2018-46, §§ 27—30, 7-17-18)

Sec. 18-660. - Standards for areas where base flood elevation data has been provided.

In addition to the requirements of section 18-659, the following standards shall apply in all special flood hazard areas where base flood data has been provided by FEMA or as set forth in subsection 18-646(c):

(a) *Residential construction.* All new construction or substantial improvement of any residential structure (including manufactured homes) shall have the lowest floor, including basement, elevated to at least two (2) feet above base flood elevation. Should solid foundation perimeter walls be used to elevate a structure, openings sufficient to facilitate the unimpeded movement of floodwaters shall be provided.

(b) *Nonresidential construction.* New construction or substantial improvement of any commercial, industrial, or nonresidential structure shall have the lowest floor, including basement, elevated at least two (2) feet above the base flood elevation. Structures located in "A" zones may be flood proofed in lieu of elevation provided that all areas of the structure below the required elevation are watertight with walls substantially impermeable to the passage of water, using structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy. A registered professional engineer or architect shall certify that the standards of this subsection are satisfied. Such certification shall be provided to the official as set forth in subsection 18-646(b).

(c) *Elevated buildings.*

(1) All new construction or substantial improvement of any elevated building that contains a fully enclosed area which is below the base flood elevation and which is formed by the foundation and other exterior walls shall:

a. Not contain any finished living space and shall not be temperature controlled or conditioned with equipment below the regulatory flood protection elevation, but shall only be used for parking of vehicles, building access, or limited storage of maintenance equipment used in connection with the premises;

b. Be constructed entirely of flood resistant materials below the regulatory flood protection elevation;

c. Be designed to allow for the entry and exit of flood waters to automatically equalize hydrostatic flood forces on exterior walls. Designs for complying with this requirement must be certified by a registered professional engineer or licensed architect or must meet the following criteria:

   i. At least two (2) openings having a total net area of not less than one (1) square inch for every square foot of enclosed area subject to flooding must be provided;

   ii. The bottom of all openings shall be no higher than one (1) foot above grade;

   iii. Openings may be equipped with screens, louvers, valves or other coverings or devices provided they permit the automatic flow of flood waters in both directions;

   iv. If a building has more than one (1) enclosed area, each area must have openings to allow floodwaters to automatically enter and exit; and

   v. Foundation enclosures made of flexible skirting are not considered enclosures for regulatory purposes and, therefore, do not require openings. Masonry or wood underpinning, regardless of structural status, is considered an enclosure and requires openings.

(2) Electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities shall be designed and located so as to prevent water from entering or accumulating within the components during flooding.

(3) Access to the enclosed area shall be the minimum amount necessary to allow for parking of vehicles, such as a garage door, or limited storage of maintenance equipment used in connection with the premises, such as a standard exterior door, or entry to the living area, such as a stairway or elevator.

(4) Except for enclosed storage areas, the interior portion of such enclosed areas shall not be partitioned or finished into separate rooms.

(5) Areas below the regulatory flood protection elevation in Coastal High Hazard Areas (Zone VE and Coastal A Zones (CAZ)) shall either be free of obstruction or constructed with breakaway walls, latticework or insect screening. This is provided they are not part of the structural support of the building and are designed so as to breakaway, under abnormally

high tides or wave action, without causing damage to the structural integrity of the building on which they are to be used, and provided the following design specifications are met:

a. Material shall consist of open wood, plastic, or other latticework or insect screening having an opening ratio of at least forty (40) percent; and

b. Breakaway walls shall meet the following design specifications:

i. Design safe loading resistance of each wall shall be not less than ten (10) nor more than twenty (20) pounds per square foot; or

ii. Breakaway walls that exceed a design safe loading resistance of more than twenty (20) pounds per square foot (either by design or when so required by State or local codes) shall be certified by a registered professional engineer or architect that the designed wall will collapse from a water load less than that which would occur during the base flood event, and the elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (structural and non-structural). The water loading values used shall be those associated with the base flood. The wind loading values used shall be those required by the North Carolina State Building Code.

iii. Breakaway walls may have flood openings that allow for the automatic entry and exit of floodwaters to minimize damage caused by hydrostatic loads.

(d) *Manufactured homes.* New and replacement manufactured homes shall be elevated on a permanent foundation such that the lowest floor of the manufactured home is elevated at least two (2) feet above the base flood elevation and must be securely anchored to an adequately anchored foundation system to resist flotation, collapse, and lateral movement:

(1) All enclosures or skirting below the lowest floor shall meet the requirements contained herein.

(2) Manufactured homes shall be securely anchored to prevent flotation, collapse, or lateral movement. For the purpose of this requirement, manufactured homes must be anchored to resist flotation, collapse, or lateral movement in accordance with the regulations for mobile homes and modular housing adopted by the commissioner of insurance pursuant to G.S. 143-143.15. Additionally, when the elevation would be met by an elevation of the chassis at least thirty-six (36) inches or less above the grade at the sight, the chassis shall be supported by reinforced piers or other foundation elements of at least equivalent strength. When the elevation of the chassis is above thirty-six (36) inches in height, an engineering certification is required.

(3)

An evacuation plan must be developed for evacuation of all residents of all new, substantially improved or substantially damaged manufactured home parks or subdivisions located within flood-prone areas. This plan shall be filed with and approved by the local administrator and the local emergency management coordinator.

(e) *Recreational vehicles.* A recreational vehicle is ready for highway use if it is on wheels or jacking system, is attached to the site only by quick-disconnect-type utilities and security devices, and has no permanently attached additions. Recreation vehicles placed on sites shall adhere to one (1) of the following:

(1) Be on the site for fewer than one hundred eighty (180) consecutive days;

(2) Be fully licensed and ready for highway use (A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities, and has no permanently attached additions); or

(3) Meet the requirements of section 18-646 and subsections 18-659(a), (d).

(f) *Temporary nonresidential structures.* Prior to the issuance of a floodplain development permit for a temporary structure, the following requirements must be met:

(1) All applicants must submit to the local administration prior to the issuance of the development permit a plan for the removal of such structure(s) in the event of a hurricane or flash flood warning notification. The plan must include the following information:

a. A specified time period for which the temporary use will be permitted not to exceed one (1) year;

b. The name, address and phone number of the individual responsible for the removal of the temporary structure;

c. The time frame prior to the event at which a structure will be removed (i.e., minimum of seventy-two (72) hours before landfall of a hurricane or immediately upon flood warning notification);

d. A copy of the contract or other suitable instrument with a trucking company to ensure the availability of removal equipment when needed; and

e. Designation, accompanied by documentation, of a location outside the special flood hazard area to which the temporary structure will be moved.

(2) The above information shall be submitted in writing to the local administrator for review and written approval.

(g) *Accessory structure.* When accessory structures (sheds, detached garages, etc.) are to be placed in the floodplain, the following criteria shall be met:

(1) Accessory structures shall be designed to have low flood damage potential.

(2)

Accessory structures shall be constructed and placed on the building site so as to offer the minimum resistance to the flow of flood waters.

(3) Accessory structures shall be firmly anchored in accordance with subsection 18-659(a)(1)a.

(4) Service facilities such as electrical shall be elevated in accordance with subsection 18-659(a)(5). Accessory structures shall not be temperature-controlled unless in compliance with requirements for principal structures.

(5) Openings to facilitate automatic equalization of hydrostatic pressure during a flood shall be provided below base flood elevation in conformance with subsection 18-660(c)(1).

(6) Accessory structures shall not be used for human habitation (including working, sleeping, living, cooking, or restroom areas).

(7) An accessory structure with a footprint of less than one hundred fifty (150) square feet and that is does not exceed a cost of three thousand dollars ($3,000.00) and satisfies the criteria above is not required to meet the elevation or floodproofing standards of this section. Elevation or floodproofing certifications are required for all other accessory structures.

(h) *Tanks.* When gas and liquid storage tanks are to be placed within a special flood hazard area, the following criteria shall be met:

(1) *Underground tanks.* Underground tanks in flood hazard areas shall be anchored to prevent flotation, collapse, or lateral movement resulting from hydrodynamic and hydrostatic loads during conditions of the design flood, including the effects of buoyancy assuming the tank is empty;

(2) *Above-ground tanks, elevated.* Above-ground tanks in flood hazard areas shall be elevated to or above the regulatory flood protection elevation on a supporting structure that is designed to prevent flotation, collapse, or lateral movement during conditions of the design flood. Tank-supporting structures shall meet the foundation requirements of the applicable flood hazard area;

(3) *Above-ground tanks, not elevated.* Above-ground tanks that do not meet the elevation requirements of this ordinance shall be permitted in flood hazard areas provided the tanks are designed, constructed, installed, and anchored to resist all flood-related and other loads, including the effects of buoyancy, during conditions of the design flood and without release of contents into the floodwaters or infiltration by floodwaters into the tanks. Tanks shall be designed, constructed, installed, and anchored to resist the potential buoyant and other flood forces acting on an empty tank during design flood construction.

(4) *Tank inlets and vents.* Tank inlets, fill openings, outlets, and vents shall be: 1) at or above the regulator flood protection elevation or fitted with covers designed to prevent the inflow of floodwater or outflow of the contents of the tanks during conditions of the

design flood; and 2) anchored to prevent lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, during conditions of the design flood.

(i) Concrete pads, including patios, decks, parking pads, walkways, driveways, pool decks, etc., shall:

(1) Be structurally independent of the primary structural foundation system of the structure and shall not adversely affect structures through redirection of floodwaters or debris; and

(2) Be constructed to breakaway cleanly during the design flood conditions, shall be frangible, and shall not produce debris capable of causing damage to any structure. The installation of concrete in small segments (not more than four (4) feet by four (4) feet) that will easily break up during the base flood event, or concrete that is scored in four-foot by four-foot segments, is acceptable to meet this standard; and

(3) Not utilize welded wire fabric, rebar, or other similar reinforcement material; and

(4) Not have a pad thickness greater than four (4) inches; and

(5) Be certified by a design professional that the design and method of construction to be used meet the applicable criteria of this section.

(6) The standards of this section shall not apply to nonresidential or multi-family development.

(j) Swimming pools and spas must be designed to withstand all flood-related loads and load combinations and be either elevated so that the lowest horizontal structure is above the regulatory flood protection elevation; or designed and constructed to break away during base flood conditions without producing debris capable of causing damage to any structure; or be sited to remain in the ground during the base flood without obstructing flow that results in damage to any structure. A registered design professional must certify to local officials that a pool or spa beneath or near a VE zone building will not be subject to flotation or displacement that will damage building foundations or elevated portions of the building or any nearby buildings during a coastal flood. Pool equipment shall be floodproofed or elevated above the regulatory flood level and shall not be located beneath an elevated structure.

(k) Elevators, vertical platform lifts, chair lifts, etc., shall comply with the following:

(1) Elevator enclosures must be designed to resist hydrodynamic and hydrostatic forces as well as erosion, scour, and waves.

(2) Utility equipment in coastal high hazard zones (VE and CAZ zones) must not be mounted on, pass through, or be located along breakaway walls.

(3) The cab, machine/equipment room, hydraulic pump, hydraulic reservoir, counter weight and roller guides, hoist cable, limit switches, electric hoist motor, electrical junction box, circuit panel, and electrical control panel are required to be above the regulatory flood

protection elevation or constructed using flood damage resistant components.

(4) Elevator shafts/enclosures that extend below the regulatory flood protection elevation shall be constructed of reinforced masonry block or reinforced concrete walls to provide increased protection from flood damage. Drainage must be provided for the elevator pit.

(5) If an elevator is designed to provide access to or from areas below the regulatory flood protection elevation, it shall be equipped with a float switch system that will activate during a flood and send the elevator cab to a flood above the regulatory flood protection elevation.

(l) *Fill/grading:* Minor grading and the placement of minor quantities of nonstructural fill may be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios, and walkways, provided:

(1) The fill material must be similar and consistent with the natural soils in the area; and

(2) The placement of site-compatible, non-structural fill under or around an elevated building is limited to two (2) feet; and

(3) Nonstructural fill with finished slopes that are steeper than five (5) units horizontal to one (1) unit vertical shall be prohibited.

(m) *Other development:* Fences, in the regulated floodways and nonencroachment areas (NEAs) that have the potential to block the passage of floodwaters, such as stockade fences and wire mesh fences; retaining walls, sidewalks, and driveways in the regulated floodways and NEAs the involve the placement of fill in regulatory floodways; and roads and watercourse crossings in regulated floodways and NEAs, including, bridges, culverts, low-water crossings, and similar means for vehicles or pedestrians to travel from one side of a watercourse to the other side, that encroach into regulated floodways and shall meet the limitations of Section 18-662.

(Ord. No. O-2006-26, §§ 1(d)—(f), 3-7-06; Ord. No. O-2018-46, §§ 31—38, 7-17-18)

Sec. 18-661. - Areas of special flood hazard.

(a) Due to the extremely hazardous nature of areas of special flood hazard, the following conditions shall apply:

(1) New solid waste disposal facilities, hazardous waste management facilities, salvage yards, and chemical storage facilities are prohibited in areas of special flood hazard except by variance as authorized under G.S. 143-215.54A(b). A structure or tank for chemical or fuel storage incidental to an allowed use or to the operation of a water treatment plant or wastewater treatment facility may be located in a special flood hazard area only if the structure or tank is either elevated or floodproofed to at least the regulatory flood protection elevation and certified in accordance with the certification requirements of this chapter.

(2)

No manufactured home shall be placed in any area of special flood hazard unless the manufactured home will be located in an existing manufactured home park or existing manufactured home subdivision. A replacement manufactured home may be placed on a lot in an existing manufactured home park or manufactured home subdivision provided the anchoring standards of subsection 18-659(a)(6) and the elevation standards of section 18-660 are met.

(b) Areas of special flood hazard may be used as a matter of right for uses that do not require structures, fill, dumping of materials, or storage of materials or equipment. No uses shall be permitted which would result in an increase in flood levels during the occurrence of the base flood.

(Ord. No. O-2018-46, § 39, 7-17-18)

Sec. 18-662. - Floodways and nonencroachment areas.

(a) Located within special flood hazard areas established in section 18-645, are areas designated as floodways or nonencroachment areas. The floodways and nonencroachment areas are extremely hazardous areas due to the velocity of flood waters which carry debris and potential projectiles and have erosion potential. The following provisions, in addition to standards outlined in section 18-659 and section 18-660, shall apply to all development within such areas:

(1) No encroachment, including fill, new construction, substantial improvements and other development, shall be allowed in any floodway or nonencroachment area unless:

a. The proposed encroachment would not result in any increase in the flood levels during the occurrence of the base flood, based on hydrologic and hydraulic analyses performed in accordance with standard engineering practice and presented to the floodplain administrator prior to issuance of floodplain development permit; or

b. A conditional letter of map revision has been approved by FEMA. A letter of map revision must also be obtained upon completion of the proposed encroachment.

(2) If subsection 18-662(a)(1) is satisfied, all development shall comply with all applicable flood hazard reduction provisions of Division III.

(3) No manufactured housing shall be permitted, except replacement manufactured homes in an existing manufactured home park or subdivision, providing the following provisions are met:

a. The anchoring and the elevation standards of subsection 18-660(d); and

b. The no encroachment standard of subsection 18-662(a)(1).

(Ord. No. O-2006-26, § 1(g), 3-7-06)

Sec. 18-663. - Standards for streams without established base flood elevations and/or floodways.

(a) Located within the areas of special flood hazard established in section 18-645 are small streams where no base flood data has been provided or where no floodways have been identified. The following provisions apply within such areas:

(1) No encroachments, including fill, new construction, substantial improvements or new development shall be permitted within a distance of the stream bank equal to two (2) times the width of the stream at the top of the bank or twenty (20) feet from each side of the top of the bank, whichever is greater, unless certification with supporting technical data by a registered professional engineer is provided demonstrating that such encroachments shall not result in any increase in flood levels during the occurrence of the base flood.

(2) If subsection 18-663(a)(1) is satisfied and base flood elevation data is available from other sources, all new construction and substantial improvements within such areas shall comply with all applicable flood hazards reduction provisions of Division 3 and shall be elevated or flood-proofed in accordance with elevations established in accordance with subsection 18-647(c). When base flood elevation data is not available from a federal, state, or other source, the lowest floor, including basement, shall be elevated at least two (2) feet above the highest adjacent grade.

(3) Until a regulatory floodway or non-encroachment area is designated, no encroachments, including fill, new construction, substantial improvements, or other development, shall be permitted unless certification with supporting technical data by a registered professional engineer is provided demonstrating that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one (1) foot at any point within the community.

(Ord. No. O-2018-46, § 40, 7-17-18)

Sec. 18-664. - Special standards for subdivision proposals and major development.

(a) All subdivision and major development proposals in accordance with regulations contained herein shall:

(1) Be consistent with minimizing flood damage within all areas of special flood hazard as provided in this article;

(2) Locate, design and construct all utilities and facilities such as sewer, gas, electrical and water systems and roads to prevent flood damage;

(3) Locate, design and construct all sanitary sewer and on-site waste disposal systems to eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters; and

(4) Provide adequate drainage to reduce exposure to flood hazards.

[(b)] Base flood elevation data shall be provided for subdivision and major and/or multi-unit development proposals in accordance with regulations contained herein which are greater than the lesser of fifty (50) lots or five (5) acres in size.

Sec. 18-665. - Standards for areas of shallow flooding (AO and AH zones).

(a) All new construction and substantial improvements of residential structures shall have the lowest floor, including basement, elevated to the depth number specified on the FIRM, in feet, above the highest adjacent grade. If no depth number is specified, the lowest floor, including basement, shall be elevated at least two (2) feet above the highest adjacent grade.

(b) All new construction and substantial improvements of nonresidential structures shall:

(1) Have the lowest floor, including basement, elevated to the depth number specified on the FIRM, in feet, above the highest adjacent grade; if no depth number is specified, the lowest floor, including basement, shall be elevated at least two (2) feet above the highest adjacent grade; or

(2) Be completely flood-proofed together with attendant utility and sanitary facilities to or above that level so that any space below that level is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy.

(3) Adequate drainage paths shall be provided around structures on slopes to guide floodwaters around and away from proposed structures.

(Ord. No. O-2018-46, §§ 41, 42, 7-17-18)

Editor's note— Ord. No. O-2018-46, § 41, adopted July 17, 2018, changed the title of § 18-665 from "standards for areas of shallow flooding (AO Zones)" to the present title.

Sec. 18-666. - Coastal high hazard areas (VE Zones and Coastal A zones (CAZ)) LiMWA.

Coastal High Hazard Areas are Special Flood Hazard Areas established in section 18-645, and designated as Zones VE or CAZ (LiMWA). These areas have special flood hazards associated with high velocity waters from surges and, therefore, in addition to meeting all other provisions in this ordinance with the exception of floodway and non-encroachment area provisions, the following provisions shall apply.

(a) All development shall be located landward of the reach of mean high tide; be located landward of the first line of stable natural vegetation; and comply with all applicable CAMA setback requirements.

(b)

All new and substantially improved structures shall be elevated so that the bottom of the lowest horizontal structural member of the lowest floor (excluding pilings or columns) is located no lower than the regulatory flood protection elevation. Floodproofing shall not be utilized on any structures in coastal high hazard areas to satisfy the regulatory flood protection elevation requirements.

(c) All space below the regulatory flood protection elevation shall be open so as not to impede the flow of water with the following exceptions:

(1) Open latticework or insect screening may be permitted below the regulatory flood protection elevation for aesthetic purposes only and must be designed to wash away in the event of abnormal wave action and in accordance with section 18-660 of this article. Design plans shall be submitted in accordance with section 18-646 of this article; or

(2) Breakaway walls may be permitted below the regulatory flood protection elevation provided they meet the criteria set forth in section 18-660 of this article. Breakaway walls used in CAZs may have flood openings that allow for the automatic entry and exit of floodwaters to minimize damage caused by hydrostatic loads. Design plans shall be submitted in accordance with section 18-646 of this article;

(d) All new and substantially improved structures shall be securely anchored on pilings or columns. All pilings and columns and the structures attached thereto shall be anchored to resist flotation, collapse, and lateral movement due to the effects of wind and water loads acting simultaneously on all building components. Water loading values used shall be those associated with the base flood. Wind loading values used shall be those required by the current edition of the North Carolina State Building Code.

(e) A registered professional engineer or architect shall certify that the design, specifications and plans for construction are in compliance with the provisions contained in section 18-646, subsections 18-666(c), (d) and (f) of this article with the most current version of North Carolina's "National Flood Insurance Program V-Zone Certification" form. In addition, prior to the certificate of compliance/occupancy issuance, a registered professional engineer or architect shall certify the finished construction is compliant with the design, specifications, and plans for VE zone construction.

(f) Fill shall not be used for structural support. Up to two (2) feet of non-compacted and non-stabilized fill may be used around the perimeter of a building for landscaping and aesthetic purposes provided the fill will wash out from storm surge, thereby rendering the building free of obstruction prior to generating excessive loading forces, ramping effects, or wave deflection. Design plans shall be submitted in accordance with section 18-646 of this article. The floodplain administrator may approve design plans for landscaping/aesthetic fill only after the applicant has provided an analysis by an engineer, architect, and/or soil scientist which demonstrates that the following factors have been satisfied:

(1) Particle composition of fill material does not have a tendency for excessive natural compaction;

(2) Volume and distribution of fill will not cause wave deflection to adjacent properties; and

(3) Slope of fill will not cause wave run-up or ramping.

(g) There shall be no alteration of sand dunes which would increase potential flood damage.

(h) No manufactured homes shall be permitted except in an existing manufactured housing park. A replacement manufactured home may be placed on a lot in an existing manufactured housing park provided the anchoring and elevation standards are in compliance with this section of ordinance.

(i) Recreational vehicles may be permitted in coastal high hazard areas provided that they meet the recreational vehicle criteria of subsection 18-660(e) of this article and the temporary structure provisions of subsection 18-660(f) of this article.

(j) A deck that is structurally attached to a building or structure shall have the bottom of the lowest horizontal structural member at or above the regulatory flood protection elevation and any supporting members that extend below the regulatory flood protection elevation shall comply with the foundation requirements that apply to the building or structure, which shall be designed to accommodate any increased loads resulting from the attached deck. The increased loads must be considered in the design of the primary structure and included in the required V-Zone certification.

(k) A deck or patio that is located below the regulatory flood protection elevation shall be structurally independent from buildings or structures and their foundation systems, and shall be designed and constructed either to remain intact and in place during design flood conditions or to break apart into small pieces to minimize debris during flooding that is capable of causing structural damage to the building or structure or to adjacent buildings or structures.

(l) In coastal high hazard areas, development activities other than buildings and structures shall be permitted only if also authorized by the appropriate state or local authority; if located outside the footprint of, and not structurally attached to, buildings and structures; and if analyses prepared by qualified registered design professionals demonstrate no harmful diversion of floodwaters or wave runup and wave reflection that would increase damage to adjacent buildings and structures. Such other development activities include but are not limited to: 1) bulkheads, seawalls, retaining walls, revetments, and similar erosion control structures; and 2) fences, unless designed and constructed to fail under flood conditions less than the design flood or otherwise function to avoid obstruction of floodwaters.

(Ord. No. O-2006-26, § 2, 3-7-06; Ord. No. O-2018-46, §§ 43, 44, 7-17-18)

Secs. 18-667—18-675. - Reserved.

DIVISION 4. - MISCELLANEOUS PROVISIONS

Sec. 18-676. - Warning and disclaimer of liability.

The degree of flood protection required by this article is considered reasonable for regulatory purposes and is based on scientific and engineering considerations provided by the Federal Insurance Administration. Larger floods can and will occur on rare occasions and flood heights may be increased by manmade or natural causes. This article does not imply that land outside the areas of special flood hazard or uses permitted within such areas will be free from flooding or flood damage. This article shall not increase liability on the part of the city or any of its officers or employees for any flood damages that result from reliance on this article or any administrative decision lawfully made hereunder. No action for damages sustained because of injury or property damage caused by a structure or obstruction for which a permit has been granted under this article shall be brought against the city or its employees or agents.

Sec. 18-677. - Amendments.

No amendment to this article shall become effective unless it has been proposed or approved by the state coordinating agency and the Federal Insurance Administration.

Sec. 18-678. - Legal status.

(a) *Effect on right and liabilities under the existing floodplain management regulations.* This article was originally adopted on March 24, 1987, as a reenactment in part of Floodplain Management Regulations adopted on April 4, 1978. It is not the intention of any amendment to this article to repeal, but rather to continue in force without interruption such provisions existing at the time of amendment, so that all rights and liabilities that have accrued under this article are reserved and may be enforced. The enactment of any amendment to this article shall not affect any action, suit or proceeding instituted or pending. All provisions of the floodplain management ordinance of the City of Wilmington which are not reenacted herein are repealed. This ordinance shall become effective upon adoption.

(b) *Effect upon outstanding building permits.* Nothing herein contained shall require any change in the plans, construction, size or designated use of any building, structure or part thereof for which a building permit has been granted by the floodplain administrator or his authorized agents before the time of passage of this article or any amendment hereto; provided, however, that when construction is not begun under such outstanding permit within a period of one hundred eighty (180) days subsequent to passage of this article or any amendment hereto, the construction or use shall be in conformity with the provisions of this article as amended.

(c) *Severability.* If any section, clause, sentence, or phrase of the floodplain management regulations is held to be invalid or unconstitutional by any court of competent jurisdiction, then said holding shall in no way effect the validity of the remaining portions of the ordinance.

(d) *Abrogation and greater restrictions.* This ordinance is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this ordinance and another conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

(e) In the interpretation of this ordinance, all provisions shall be considered as minimum requirements; liberally construed in favor of the governing body; and deemed neither to limit nor repeal any other powers granted under state statutes.

(Ord. No. O-2018-46, §§ 45—47, 7-17-18)

Secs. 18-679—18-685. - Reserved.

Appendix J

Soil Survey Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for New Hanover County, North Carolina



September 13, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
New Hanover County, North Carolina.....13
Be—Baymeade fine sand, 1 to 6 percent slopes.....13
Kr—Kureb sand, 1 to 8 percent slopes.....14
La—Lakeland sand, 1 to 8 percent slopes.....15
Ur—Urban land.....16
W—Water.....17
References.....18

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:4,220 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: New Hanover County, North Carolina
Survey Area Data: Version 24, Sep 12, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 8, 2022—Dec 1, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Be	Baymeade fine sand, 1 to 6 percent slopes	1.9	4.6%
Kr	Kureb sand, 1 to 8 percent slopes	3.1	7.6%
La	Lakeland sand, 1 to 8 percent slopes	13.4	32.6%
Ur	Urban land	21.9	53.4%
W	Water	0.7	1.8%
Totals for Area of Interest		**41.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

New Hanover County, North Carolina

Be—Baymeade fine sand, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 3wr0
Elevation: 20 to 160 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Baymeade and similar soils: 90 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Baymeade

Setting

Landform: Ridges on marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy and sandy marine deposits

Typical profile

A - 0 to 2 inches: fine sand
E/Bh - 2 to 30 inches: fine sand
Bt - 30 to 40 inches: fine sandy loam
C - 40 to 80 inches: loamy fine sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 48 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Lynn haven, undrained

Percent of map unit: 2 percent
Landform: Flats on marine terraces

Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Murville, undrained

Percent of map unit: 2 percent
Landform: Flats on marine terraces, depressions on marine terraces
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Leon

Percent of map unit: 2 percent
Landform: Flats on marine terraces
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Torhunta, undrained

Percent of map unit: 2 percent
Landform: Depressions on stream terraces, carolina bays on marine terraces, flats on marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Kr—Kureb sand, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3wr7
Elevation: 0 to 20 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Kureb and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kureb

Setting

Landform: Ridges on marine terraces, rims on carolina bays
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Eolian sands and/or sandy fluviomarine deposits

Typical profile

A - 0 to 3 inches: sand
E - 3 to 26 inches: sand
C/Bh - 26 to 89 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Leon

Percent of map unit: 5 percent
Landform: Flats on marine terraces
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

La—Lakeland sand, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3wr9
Elevation: 0 to 20 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Lakeland and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lakeland

Setting

Landform: Ridges on marine terraces
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Eolian sands and/or sandy fluviomarine deposits

Typical profile

A - 0 to 2 inches: sand
C - 2 to 80 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Leon

Percent of map unit: 3 percent
Landform: Flats on marine terraces
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Ur—Urban land

Map Unit Composition

Urban land: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix K

Soil and Groundwater Sampling Report
Southside WWTP Expansion
Wilmington Police Department Firing Range

SOIL AND GROUNDWATER SAMPLING REPORT
SOUTHSIDE WWTP EXPANSION
WILMINGTON POLICE DEPARTMENT FIRING RANGE
3900 RIVER ROAD
WILMINGTON, NORTH CAROLINA

S&ME Project No. 1054-13-309

Prepared for:

Cape Fear Public Utility Authority
235 Government Center Drive
Wilmington, North Carolina 28403

Prepared by:

S&ME, Inc.
3201 Spring Forest Road
Raleigh, North Carolina 27616

Paul Masten, L.S.S.
Project Manager

Thomas P. Raymond, P.E.
Senior Consultant

January 16, 2014

TABLE OF CONTENTS

1.0 SCOPE OF SERVICES 1

2.0 BACKGROUND 1

3.0 PROJECT COORDINATION AND SITE SAFETY 1

4.0 SOIL SAMPLING 1

4.1 SOIL SAMPLING METHODOLOGY 1
4.2 SOIL SAMPLING RESULTS 2

5.0 GROUNDWATER SAMPLING 3

6.0 CONCLUSIONS AND RECOMMENDATIONS 4

FIGURES

FIGURE 1 VICINITY MAP
FIGURE 2 SOIL SAMPLE LOCATION MAP
FIGURE 3 SOIL BERM SAMPLING AND DETAIL SKETCH
FIGURE 4 GROUNDWATER SAMPLE LOCATION MAP

TABLES

TABLE 1 SOIL RESULTS TABLE
TABLE 2 GROUNDWATER RESULTS TABLE

APPENDICES

APPENDIX I SOIL BORING LOGS
APPENDIX II LABORATORY ANALYTICAL REPORT AND CHAIN OF CUSTODY FORM

1.0 SCOPE OF SERVICES

This scope of services was performed in general accordance with S&ME's Proposal No. P154-13V dated June 20, 2013. S&ME's approved Scope of Services included collecting 13 soil samples via hand auger borings, collection of two groundwater samples via installation of two temporary monitoring wells, and preparation of this report.

2.0 BACKGROUND

S&ME was contacted by Mr. Craig Wilson on May 16, 2013 at which time Mr. Wilson informed us that Cape Fear Public Utility Authority (CFPUA) intends to expand the existing Southside Wastewater Treatment Plant (WWTP) located at 3436 River Road. Part of the expansion will include demolition and/or renovation of several existing buildings/structures at the plant and use of the nearby Wilmington Police Department firing range for contractor lay-down area. In preparation for these activities, Mr. Wilson requested that S&ME perform a lead-containing paint and asbestos-containing building materials assessment of the buildings to be demolished or renovated at the plant as well as soil and groundwater sampling at the firing range. The findings of the building assessments have been provided in a separate report. See **Figure 1** for a vicinity map.

The firing range property consisted of a gravel parking area, an abandoned building, a soil berm used as the shooting backstop, the shooting range yard which included crossing asphalt paths installed a specific distances from the soil berm and an ammunition disposal area in the northeast corner of the shooting range yard. See **Figure 2** for these site features.

3.0 PROJECT COORDINATION AND SITE SAFETY

Prior to mobilization for soil and groundwater sampling activities, S&ME personnel drafted a site-specific health and safety plan (HASP) which was used by S&ME personnel. We also notified NC One Call to have underground utilities marked and coordinated with a private utility locator to mark private utilities and utilities not marked by NC One Call.

4.0 SOIL SAMPLING

4.1 Soil Sampling Methodology

S&ME mobilized to the site on September 19 and 20, 2013 to collect 13 soil samples via hand auger borings (S-1 through S-13). Samples S-01 through S-05 were composite soil samples collected from the top foot of soil in the gravel parking area, from various shooting ranges in the shooting range yard and from the ammunition disposal area. Samples S-6 through S-13 were collected from the soil berm from depths ranging from the surface to three feet. The attached **Table 1** provides the depth of sample at each sample location and **Figures 2** and **3** shows the sample locations.

Several additional soil samples were collected and archived by the laboratory to hold for future analysis if warranted by the results of the initial sampling. Those included a background sample collected from a wooded area outside of the shooting range yard, a sample from the side-wing of the soil berm, a sample collected from four feet bgs at location S-04 and a sample collected from four feet into the approximate middle of the soil berm.

For the composite soil samples, portions of each sub-sample were composited prior to placement into laboratory supplied containers. Following soil compositing or grab sample collection, soil samples were placed in laboratory-supplied containers, stored in an insulated container with ice, and shipped under standard Chain-of-Custody procedures to ESC Lab Sciences of Mt. Juliet, Tennessee, a North Carolina certified laboratory. Soil samples were analyzed for lead via EPA Method 6010 and polycyclic aromatic hydrocarbons (PAHs) only via EPA Method 8270.

Sample depths for the soil samples collected from the parking lot, shooting yard and ammunition disposal area are vertical distances from the ground surface. Sample depths for the soil berm samples are horizontal distances from the front face of the berm.

Investigative derived wastes (IDW), such as soil cuttings generated during the soil boring advancement were disposed of in accordance with the procedures specified by the North Carolina Department of Environment and Natural Resources (NCDENR). Specifically, the soil cuttings were used to backfill borings.

4.2 Soil Sampling Results

Dry, loose fine sand typical of relic alluvial deposits located along the Cape Fear River was encountered at all of the sampling locations. Debris typically associated with shooting, including shells, casings, bullets and plastic were also observed in the soil berm as well.

Laboratory analytical results indicated the presence of lead at concentrations that exceeded the Inactive Hazardous Sites Branch (IHSB) Preliminary Soil Remediation Goals (PRSGs) for industrial sites, residential site PSRG and/or Protection of Groundwater PSRG from several samples collected from the soil berm. Lead was detected at concentrations below PSRGs from samples collected from the parking lot, the shooting range yard and the ammunition disposal area.

Laboratory analytical results indicated the presence of the following PAHs at concentrations above their respective PSRGs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene . The following PAHs were detected at concentrations below their respective PSRGs in samples collected from the parking lot, shooting range and the ammunition disposal area: anthracene, acenaphthene, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)flouranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, naphthalene, phenanthrene and pyrene.

The soil sampling locations are shown on **Figures 2** and **3** and summarized in **Table 1**. The laboratory analytical report for the soil samples is included in **Appendix II**. On December 13, 2013 Mr. Wilson informed us that the City of Wilmington has extensive, historic soil sampling data from the firing range. That data was not provided to be discussed in this report.

5.0 GROUNDWATER SAMPLING

5.1 Groundwater Sampling Methodology

On September 19, 2013, S&ME and our drilling subcontractor advanced soil borings using Geoprobe® direct push technology in order to install two temporary monitoring wells (MW-1 and MW-2) near the base of the soil berm to depths of approximately 15 feet below the existing ground surface. During boring advancement the soils were collected in five-foot long clear, acetate liners. The soil recovered was then classified by S&ME field personnel. The soil boring logs for both borings are included in **Appendix I**. See **Figure 4** for the location of the temporary monitoring wells.

5.2 Groundwater Sampling Results

At MW-1, soils transitioned from fine sand at and near the surface to silty sand and finally to silty clay encountered below the groundwater. Groundwater was measured at approximately 7.49 feet below the existing ground surface at MW-1. Apparent soil saturation was encountered at MW-2 at approximately 8.5 feet below the ground surface with a low permeability clay horizon encountered immediately below this depth. The temporary monitoring well was installed at 10 feet. However, groundwater was not encountered in the temporary monitoring well so S&ME remobilized the Geoprobe on September 23, 2013 to extend the boring to 20 feet below the ground surface but groundwater was not encountered at that depth either. Therefore, a second boring was advanced a few feet west of the initial boring to a depth of 15 feet below the ground surface. Similar soil stratification was encountered at the offset location and groundwater was not encountered thus a groundwater sample was not collected at MW-2. It should be noted that MW-1 and MW-2 were installed at similar ground surface elevations. As such, it appears that the low permeability clay encountered at this location is perching downward infiltrating water but preventing the upward or lateral movement of groundwater to a similar elevation as that encountered at MW-1. Soil boring logs have been included for both locations in **Appendix I**.

The temporary monitoring wells were installed using 1.75-inch diameter slotted PVC piping with a sand pack in the interstitial space between the borehole and the well piping. The groundwater level was measured and well volume determined. A peristaltic pump was then used to develop MW-1 until a relatively clear flow was achieved. Temperature, pH and conductivity measurements were also collected during well development to help document stabilized groundwater parameters. It should be noted that MW-1 went dry shortly after development began with minimal amounts of groundwater slowly recharging the well, thus only two sets of parameter measurements were collected.

Laboratory analytical results indicated the presence of lead and two PAHs, naphthalene and 2-methylnaphthalene, at concentrations below their respective 2L Groundwater Standards. Groundwater analytical results have been summarized in **Table 2** and laboratory data sheets have been included in **Appendix II**.

6.0 CONCLUSIONS AND RECOMMENDATIONS

S&ME performed soil and groundwater sampling at the Wilmington Police Department firing range on September 19 and 20, 2013. The findings at the site are as follows:

- Shells, casings and other debris typically associated with firearm discharge were observed on the ground surface of the shooting range yard and in the soil berm.

- Laboratory analytical results of soil samples indicated the presence of three PAHs at concentrations above their respective PSRGs in the soil berm. Multiple other PAHs were detected at concentrations below their respective PSRGs from the other samples. Lead was detected at concentrations above its PSRG in samples collected from the soil berm and from the composite sample collected from the shooting range yard closest to the soil berm. Lead was detected at concentrations below its PSRG in the other soil samples.

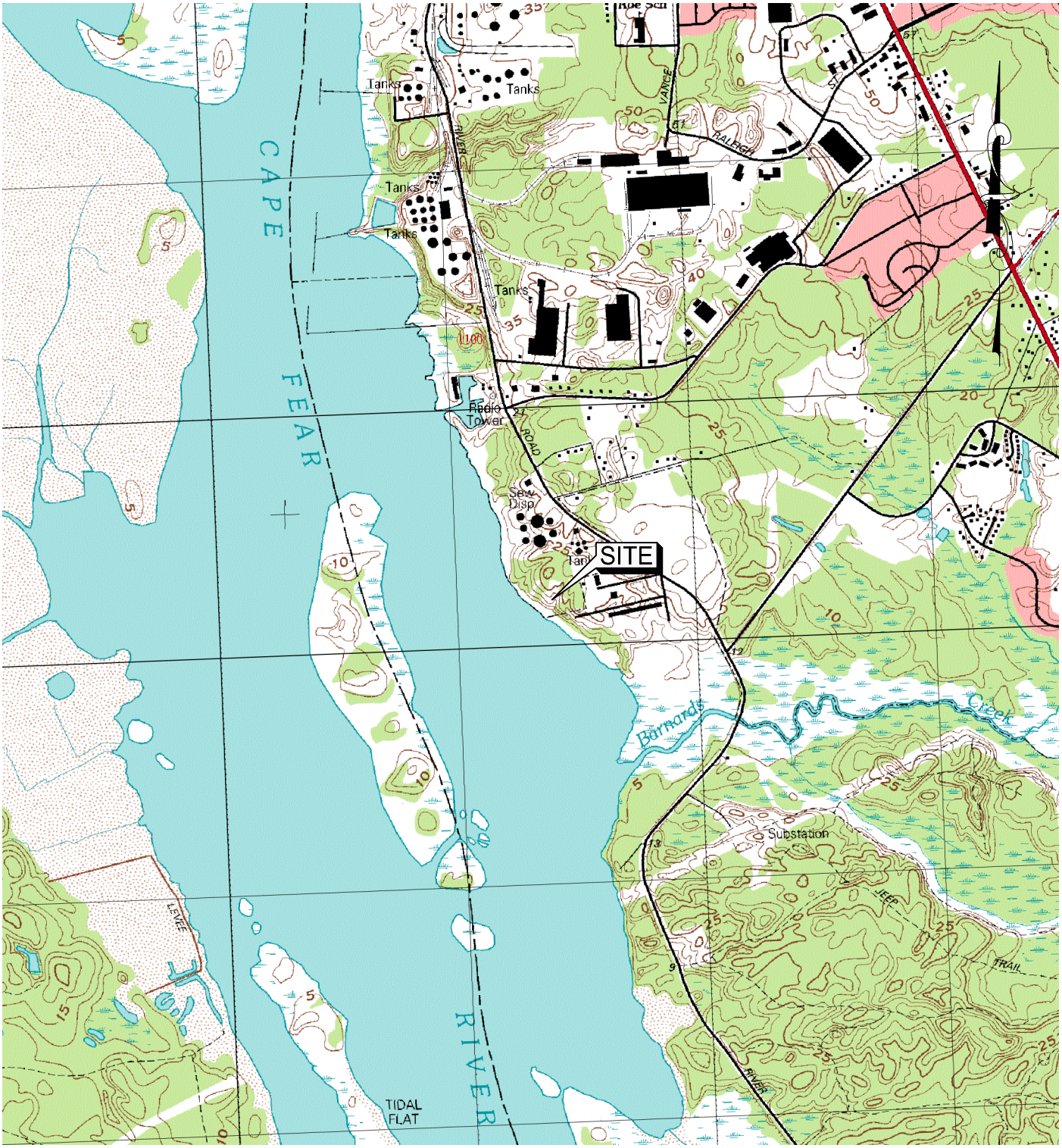
- Laboratory analytical results of groundwater samples indicated the presence of lead and two PAHs at concentrations below their respective 2L Groundwater Standards.

- S&ME personnel discussed the results and potential next steps with Mr. Wilson on various occasions from October through December 2013. The last conversation occurred on December 13, 2013 at which time Mr. Wilson informed S&ME that no additional soil or groundwater analyses would be needed at this time.

If the shooting range yard is to be used for contractor lay-down area, S&ME recommends isolating the ground surface and berm to avoid soil contact with contractor personnel. S&ME can assist CFPUA with development of contaminant action plans if requested, but such was beyond this scope of services.

Please note that it is the responsibility of the property owner to notify regulatory agencies when a release has been identified on their property. S&ME will not provide a copy of this report to regulatory personnel unless requested by CFPUA to do so.

FIGURES



GRAPHIC SCALE

1000 0 500 1000 2000

(IN FEET)

TOPO SOURCE: NCGS DRG
WILMINGTON, DATED 1993
CONTOUR INTERVAL 5 FEET

A-3921

SCALE:	1" = 2000'
DATE:	SEPT 2013
DRAWN BY:	BTR
PROJECT NO:	1054-13-309

S&ME
WWW.SMEINC.COM
NC ENGINEER LICENSE #F-0176
3201 SPRING FOREST RD, RALEIGH, NC 27616

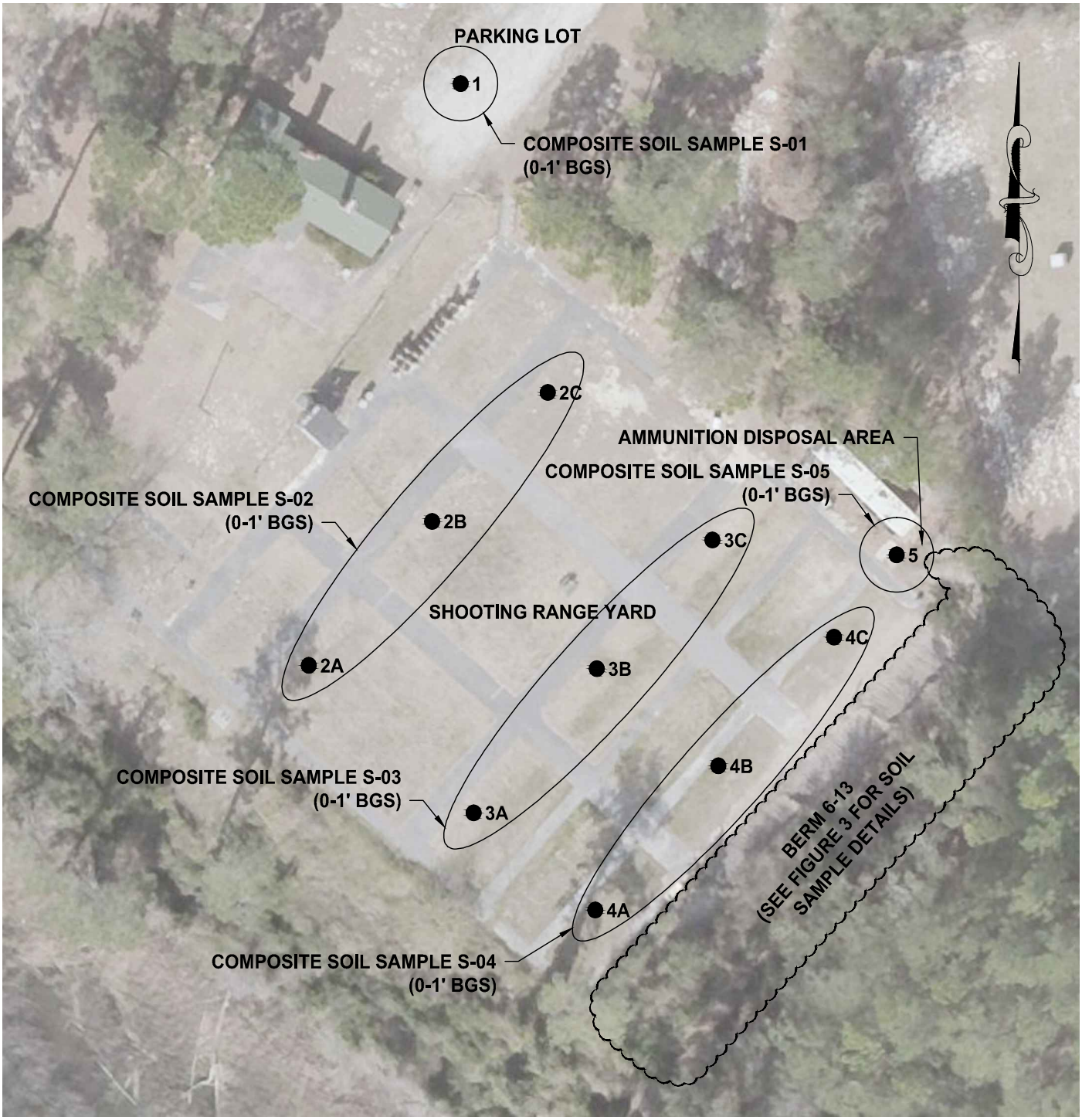
VICINITY MAP

WILMINGTON POLICE DEPARTMENT FIRING RANGE
WILMINGTON, NORTH CAROLINA

FIGURE NO.

1

S:\PROJECTS\2013\13-309 Southside WWTP Lead & Asbestos Sampling\CADA\3922.dwg, FIG1, 10/8/2013 9:26:32 AM, 1:1



LEGEND

● SOIL SAMPLE LOCATION
SAMPLES COLLECTED SEPTEMBER 19 & 20, 2013
BGS - BELOW GROUND SURFACE

GRAPHIC SCALE

25 0 12.5 25 50

(IN FEET)

IMAGE SOURCE: NC ONEMAP, DATED 2012

A-3923

SCALE:	1" = 50'
DATE:	SEPT 2013
DRAWN BY:	BTR
PROJECT NO:	1054-13-309

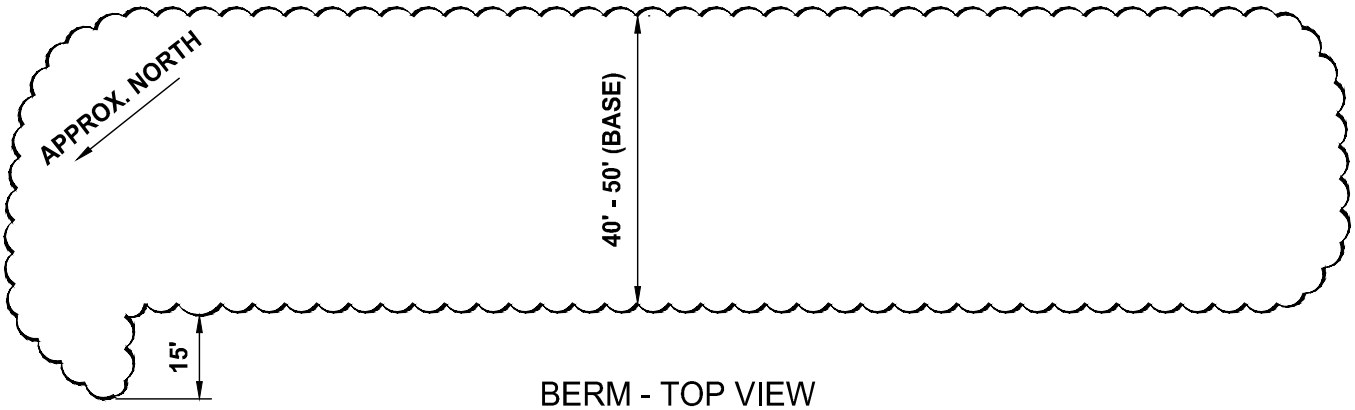
S&ME
WWW.SMEINC.COM
NC ENGINEER LICENSE #F-0176
3201 SPRING FOREST RD, RALEIGH, NC 27616

SOIL SAMPLE LOCATION MAP

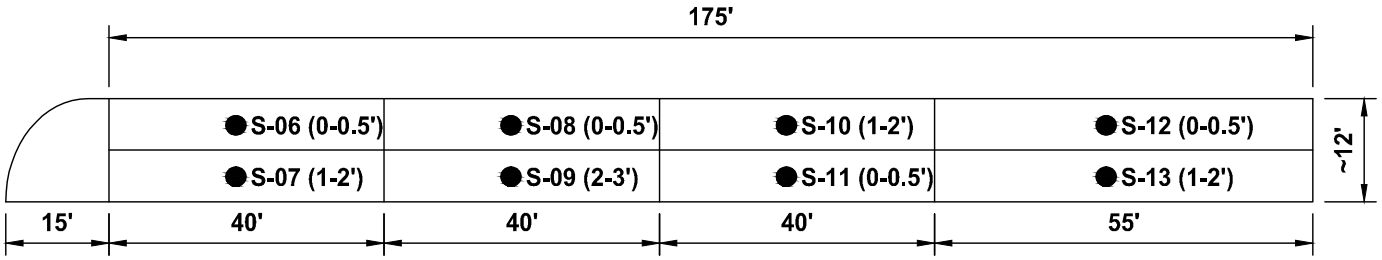
WILMINGTON POLICE DEPARTMENT FIRING RANGE
WILMINGTON, NORTH CAROLINA

FIGURE NO.
2

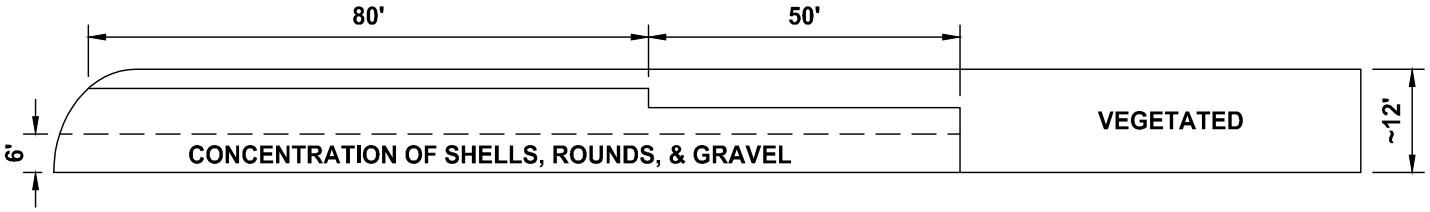
S:\PROJECTS\2013\13-309 Southside WWTP Lead & Asbestos Sampling\CADA\3923.dwg, FIG2, 1/6/2014 11:41:40 AM, 1:1



BERM - TOP VIEW



BERM - FRONT VIEW (NORTHWEST FACE)



BERM - FRONT VIEW (NORTHWEST FACE)

A-4041

SCALE:	NTS
DATE:	JAN 2014
DRAWN BY:	BTR
PROJECT NO:	1054-13-309

S&ME
WWW.SMEINC.COM
NC ENGINEER LICENSE #F-0176
3201 SPRING FOREST RD, RALEIGH, NC 27616

SOIL BERM DETAIL

WILMINGTON POLICE DEPARTMENT FIRING RANGE
WILMINGTON, NORTH CAROLINA

FIGURE NO.
3

S:\PROJECTS\2013\13-309 Southside WWTP Lead & Asbestos Sampling\CADVA4041.dwg, FIG3, 1/6/2014 11:49:39 AM, 1:1



LEGEND

- GROUNDWATER SAMPLE LOCATION
  GROUNDWATER COLLECTED FROM MW-1 ON 9-19-2013
  GROUNDWATER NOT COLLECTED FOR MW-2

GRAPHIC SCALE

25 0 12.5 25 50

(IN FEET)

IMAGE SOURCE: NC ONEMAP, DATED 2012

A-3924

SCALE:	1" = 50'
DATE:	SEPT 2013
DRAWN BY:	BTR
PROJECT NO:	1054-13-309

S&ME
WWW.SMEINC.COM
NC ENGINEER LICENSE #F-0176
3201 SPRING FOREST RD, RALEIGH, NC 27616

GROUNDWATER SAMPLE LOCATION MAP

WILMINGTON POLICE DEPARTMENT FIRING RANGE
WILMINGTON, NORTH CAROLINA

FIGURE NO.

4

S:\PROJECTS\2013\13-309 Southside WWTP Lead & Asbestos Sampling\CADA3924.dwg, FIG4, 1/6/2014 4:50:52 PM, 1:1

TABLES

Table 1
Summary of Soil Analytical Results
Southside WWTP Firing Range Sampling
Wilmington, North Carolina
S&ME Project Number: 1054-13-309

EPA Method				6020 (Lead)	8270 (Polycyclic Aromatic Hydrocarbons)															
Sample ID	Sample Location	Sample Depth (ft-bgs)	Parameter / Date	Lead	Anthracene	Acenaphthene	Acenaphthylene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	(Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthanlene	Phenanthrene	Pyrene
S-01	Composite from Parking Lot	0-1	9/19/2013	3.5	BDL	BDL	BDL	BDL	BDL	0.00077	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.0045	BDL	BDL
S-02	Composite from sub-samples 2A, 2B, 2C	0-1	9/19/2013	12	0.0011	0.001	BDL	0.011	**0.018**	0.016	0.013	0.0064	0.018	0.0034	0.01	BDL	0.0095	0.0029	0.0056	0.015
S-03	Composite from sub-samples 3A, 3B, 3C	0-1	9/19/2013	16	0.00065	BDL	BDL	0.0039	0.0068	0.0076	0.0058	0.002	0.0066	0.0013	0.0049	BDL	0.0039	0.0031	0.0023	0.005
S-04	Composite from sub-samples 4A, 4B, 4C	0-1	9/19/2013	160	0.0021	0.0037	0.00068	0.0069	0.0095	0.012	0.0084	0.0032	0.01	0.0021	0.016	0.0016	0.0065	0.0033	0.012	0.011
S-05	Composite from Ammo Disposal Area	0-1	9/19/2013	16	BDL	BDL	BDL	BDL	BDL	0.00066	0.00097	BDL	0.00072	BDL	BDL	BDL	BDL	0.0029	BDL	BDL
S-06	Soil Berm	0-0.5	9/20/2013	**10000**	0.022	BDL	0.0088	**0.33**	**0.49**	**0.75**	0.44	0.24	0.52	**0.1**	0.95	0.0069	**0.38**	0.034	0.22	0.56
S-07	Soil Berm	1-2	9/20/2013	**72000**	0.023	0.0066	BDL	0.11	**0.18**	**0.21**	0.14	0.073	0.17	**0.033**	0.19	0.0052	0.11	0.01	0.066	0.14
S-08	Soil Berm	0-0.5	9/20/2013	**12000**	0.02	0.0062	BDL	**0.28**	**0.41**	**0.64**	0.4	0.2	0.45	**0.09**	0.76	0.0062	**0.34**	BDL	0.17	0.47
S-09	Soil Berm	2-3	9/20/2013	95.7	BDL	BDL	BDL	0.0012	0.0017	0.0018	0.0014	BDL	0.0012	BDL	0.0016	BDL	0.00094	0.0027	0.00063	0.0015
S-10	Soil Berm	1-2	9/20/2013	**5700**	0.0037	BDL	0.0018	0.014	**0.023**	0.031	0.015	0.0086	0.024	0.0046	0.015	BDL	0.011	0.0034	0.0033	0.016
S-11	Soil Berm	0-0.5	9/20/2013	**29000**	0.049	0.017	0.013	**0.3**	**0.5**	**0.64**	0.41	0.24	0.44	**0.099**	0.55	0.0082	**0.34**	BDL	0.13	0.38
S-12	Soil Berm	0-0.5	9/20/2013	**260**	0.00068	BDL	BDL	0.0041	0.0051	0.0076	0.0036	0.0019	0.0058	0.00097	0.0054	BDL	0.0028	0.0026	0.001	0.0047
S-13	Soil Berm	1-2	9/20/2013	96.9	0.0047	0.0057	BDL	0.033	**0.055**	0.058	0.036	0.018	0.037	0.01	0.034	0.0012	0.031	0.004	0.011	0.028
IHSB Preliminary Industrial Soil Remediation Goals (PSRG)				800	34000	6600	NA	21	0.21	2.1	NR	21	210	0.21	4400	4400	2.1	18	NR	3400
Protection of Groundwater PSRG				270	660	8.4	21	0.18	0.059	0.6	7800	5.9	18	0.19	330	56	2	0.21	68	220
IHSB Preliminary Residential Soil Remediation PSRG				400	3400	680	NA	0.15	0.015	0.15	NR	1.5	15	0.015	460	460	0.15	3.6	NR	340

Notes: See Figures 2 and 3 for sample locations

NA: Not applicable
Concentrations are reported in milligrams per kilogram (mg/kg).
BDL: Below Detection Limit of the Laboratory
Analytes that are not shown for the method were not detected.
ft-bgs: feet below ground surface
All samples that exceed the IHSB standards are shown in **BOLD** fields and highlighted yellow for exceedence of one standard, orane for exceedence of two standards and red for exceedence of three standards.
See **Figure 1** for sample locations.

Table 2
Summary of Groundwater Analytical Results
Southside WWTP Firing Range Sampling
Wilmington, North Carolina
S&ME Project Number: 1054-13-309

EPA Method			8270 (PAHs)		6020 (Lead)
Sample ID	Depth of Temporary Well (ft-bgs)	Parameter / Date	Naphthalene	2-Methylnaphthalene	Lead
MW-1	15	9/19/2013	0.0079	0.0022	2.5
2L Groundwater Standard			6	30	15

Notes:
Concentrations are reported in micrograms per liter (µg/L).
Analytes that are not shown for the method were not detected.
See **Figure 4** for sample locations.

APPENDIX I

Soil Boring Logs and Well Construction Logs

SUMMARY OF GEOPROBE BORING

Project Name: Southside WWTP Firing Range Sampling

Project No.: 1054-13-309

Boring Number: MW-1
Sampling Personnel: Paul Masten
Date Drilled: 9/19/20, Geoprobe
Depth to Groundwater: 7.5'
Total Boring Depth: 15'

Depth (ft-bgs)		SOIL DESCRIPTION
To	From	
0	0.5	Brown fine sand, dry, loose
0.5	1	White fine sand, dry, loose
1	3	Tan fine sand, dry, loose
3	9	Light tan sand, dry, loose
9	9.5	Tan/orange/red fine sand, saturated
9.5	10	Tan/light brown silty sand
10	13	Brown silty clay, very firm
13	15	Gray silty clay, very firm

Notes:
ft. bgs.= Depth in feet below ground surface
PID = Photo-ionization detector (readings in parts per million or ppm)
FID = Flame-ionization detector (readings in parts per million or ppm)
-- = No data or paramter not collected

SUMMARY OF GEOPROBE BORING

Project Name: Southside WWTP Firing Range Sampling

Project No.: 1054-13-309

Boring Number: MW-2
Sampling Personnel: Paul Masten
Date Drilled: 9/23/20, Geoprobe
Depth to Groundwater: Not Encountered
Total Boring Depth: 15'

S&ME

Depth (ft-bgs)		SOIL DESCRIPTION
To	From	
0	1	Gray/brown fine sand, dry, loose
1	7.5	Light tan fine sand, dry, loose
7.5	10	Gray clay, very firm
10	13	Tan sandy clay, firm
13	15	Gray clay, very firm

Notes:
ft. bgs.= Depth in feet below ground surface
PID = Photo-ionization detector (readings in parts per million or ppm)
FID = Flame-ionization detector (readings in parts per million or ppm)
-- = No data or paramter not collected

WELL CONSTRUCTION RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

George R. Bridger

Well Contractor Name

2393-A

NC Well Contractor Certification Number

Bridger Drilling Entrp., Inc. dba Carolina Drilling

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.)

3. Well Use (check well use):

Water Supply Well:

☐Agricultural ☐Municipal/Public

☐Geothermal (Heating/Cooling Supply) ☐Residential Water Supply (single)

☐Industrial/Commercial ☐Residential Water Supply (shared)

☐Irrigation

Non-Water Supply Well:

☑Monitoring ☐Recovery

Injection Well:

☐Aquifer Recharge ☐Groundwater Remediation

☐Aquifer Storage and Recovery ☐Salinity Barrier

☐Aquifer Test ☐Stormwater Drainage

☐Experimental Technology ☐Subsidence Control

☐Geothermal (Closed Loop) ☐Tracer

☐Geothermal (Heating/Cooling Return) ☐Other (explain under #21 Remarks)

4. Date Well(s) Completed: 9/19/13 **Well ID#** MW-1

5a. Well Location:

Southside WWTP Firing Range Sampling

Facility/Owner Name

Facility ID# (if applicable)

City of Wilmington - 3900 River Road - Wilmington, NC

Physical Address, City, and Zip

New Hanover

County

Parcel Identification No. (PIN)

5b. Latitude and Longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

6. Is (are) the well(s): ☐**Permanent** or ☑**Temporary**

7. Is this a repair to an existing well: ☐**Yes** or ☐**No**

If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. Number of wells constructed: 1

*For multiple injection or non-water supply wells **ONLY** with the **same construction**, you can submit one form.*

9. Total well depth below land surface: 15 **(ft.)**

For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 8.99 **(ft.)**

If water level is above casing, use "+"

11. Borehole diameter: 3 **(in.)**

12. Well construction method: direct push

(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

For Internal Use ONLY:

14. WATER ZONES

FROM	TO	DESCRIPTION
ft.	ft.	
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		
ft.	ft.	in.		

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
5 ft.	15 ft.	3/4 in.	.010	sch40	pvc
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
n/a ft.	ft.		
ft.	ft.		
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
3 ft.	15 ft.		
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

22. Certification:

Signature of Certified Well Contractor

1/13/14

Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:

You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells ONLY: In addition to sending the form to the address in 24a above, also submit a copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells:

Also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

WELL CONSTRUCTION RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

George R. Bridger

Well Contractor Name

2393-A

NC Well Contractor Certification Number

Bridger Drilling Entrp., Inc. dba Carolina Drilling

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.)

3. Well Use (check well use):

Water Supply Well:

☐Agricultural ☐Municipal/Public

☐Geothermal (Heating/Cooling Supply) ☐Residential Water Supply (single)

☐Industrial/Commercial ☐Residential Water Supply (shared)

☐Irrigation

Non-Water Supply Well:

☑Monitoring ☐Recovery

Injection Well:

☐Aquifer Recharge ☐Groundwater Remediation

☐Aquifer Storage and Recovery ☐Salinity Barrier

☐Aquifer Test ☐Stormwater Drainage

☐Experimental Technology ☐Subsidence Control

☐Geothermal (Closed Loop) ☐Tracer

☐Geothermal (Heating/Cooling Return) ☐Other (explain under #21 Remarks)

4. Date Well(s) Completed: 9/19/13 **Well ID#** MW-2

5a. Well Location:

Southside WWTP Firing Range Sampling

Facility/Owner Name

Facility ID# (if applicable)

City of Wilmington - 3900 River Road - Wilmington, NC

Physical Address, City, and Zip

New Hanover

County

Parcel Identification No. (PIN)

5b. Latitude and Longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

6. Is (are) the well(s): ☐Permanent or ☑Temporary

7. Is this a repair to an existing well: ☐Yes or ☐No

If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. Number of wells constructed: 1

*For multiple injection or non-water supply wells **ONLY** with the **same construction**, you can submit one form.*

9. Total well depth below land surface: 15 (ft.)

For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 0 No Water (ft.)

If water level is above casing, use "+"

11. Borehole diameter: 3 (in.)

12. Well construction method: direct push

(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

For Internal Use ONLY:

14. WATER ZONES

FROM	TO	DESCRIPTION
ft.	ft.	
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		
ft.	ft.	in.		

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
5 ft.	15 ft.	3/4 in.	.010	sch40	pvc
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
n/a ft.	ft.		
ft.	ft.		
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
3 ft.	15 ft.		
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

22. Certification:

Signature of Certified Well Contractor — Date: 1/13/14

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

**Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617**

24b. For Injection Wells ONLY: In addition to sending the form to the address in 24a above, also submit a copy of this form within 30 days of completion of well construction to the following:

**Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636**

24c. For Water Supply & Injection Wells:
Also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

APPENDIX II

Laboratory Analytical Report and Chain of Custody Form

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

Report Summary

Tuesday October 08, 2013

Report Number: L658895
Samples Received: 09/21/13
Client Project: 1054-13-309

Description: CFPUA Firing Range

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Entire Report Reviewed By: Jimmy Hunt

Jimmy Hunt , ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 100789, AL - 40660, CA - 01157CA, CT - PH-0197, FL - E87487, GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375/DW21704/BIO041, ND - R-140. NJ - TN002, NJ NELAP - TN002, SC - 84004, TN - 2006, VA - 460132, WV - 233, AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, NV - TN000032011-1, TX - T104704245-11-3, OK - 9915, PA - 68-02979, IA Lab #364

Accreditation is only applicable to the test methods specified on each scope of accreditation held by ESC Lab Sciences.
Note: The use of the preparatory EPA Method 3511 is not approved or endorsed by the CA ELAP.

This report may not be reproduced, except in full, without written approval from ESC Lab Sciences.
Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-01

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-1

Collected By : Paul Masten
Collection Date : 09/19/13 10:05

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	79.6	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	3.5	0.095	0.31	mg/kg		6010B	09/26/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Acenaphthene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Acenaphthylene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Benzo(a)anthracene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Benzo(a)pyrene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Benzo(b)fluoranthene	0.00077	0.00060	0.0075	mg/kg	J	8270D-SI	09/30/13	1
Benzo(g,h,i)perylene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Benzo(k)fluoranthene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Chrysene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Dibenz(a,h)anthracene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Fluoranthene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Fluorene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Indeno(1,2,3-cd)pyrene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Naphthalene	0.0045	0.0020	0.025	mg/kg	J	8270D-SI	09/30/13	1
Phenanthrene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
Pyrene	U	0.00060	0.0075	mg/kg		8270D-SI	09/30/13	1
1-Methylnaphthalene	U	0.0020	0.025	mg/kg		8270D-SI	09/30/13	1
2-Methylnaphthalene	U	0.0020	0.025	mg/kg		8270D-SI	09/30/13	1
2-Chloronaphthalene	U	0.0020	0.025	mg/kg		8270D-SI	09/30/13	1
Surrogate Recovery								
Nitrobenzene-d5	90.9			% Rec.		8270D-SI	09/30/13	1
2-Fluorobiphenyl	90.2			% Rec.		8270D-SI	09/30/13	1
p-Terphenyl-d14	80.6			% Rec.		8270D-SI	09/30/13	1

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:09

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-02

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-2

Collected By : Paul Masten
Collection Date : 09/19/13 10:44

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	96.9	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	12.	0.095	0.26	mg/kg		6010B	10/07/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.0011	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Acenaphthene	0.0010	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Acenaphthylene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(a)anthracene	0.011	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(a)pyrene	0.018	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(b)fluoranthene	0.016	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(g,h,i)perylene	0.013	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(k)fluoranthene	0.0064	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Chrysene	0.018	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Dibenz(a,h)anthracene	0.0034	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Fluoranthene	0.010	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Fluorene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Indeno(1,2,3-cd)pyrene	0.0095	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Naphthalene	0.0029	0.0020	0.021	mg/kg	J	8270D-SI	09/30/13	1
Phenanthrene	0.0056	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Pyrene	0.015	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
1-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Chloronaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
Surrogate Recovery								
Nitrobenzene-d5	89.3			% Rec.		8270D-SI	09/30/13	1
2-Fluorobiphenyl	92.1			% Rec.		8270D-SI	09/30/13	1
p-Terphenyl-d14	85.8			% Rec.		8270D-SI	09/30/13	1

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:09

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-03

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-3

Collected By : Paul Masten
Collection Date : 09/19/13 11:20

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	97.1	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	16.	0.095	0.26	mg/kg		6010B	10/07/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.00065	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Acenaphthene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Acenaphthylene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(a)anthracene	0.0039	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Benzo(a)pyrene	0.0068	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(b)fluoranthene	0.0076	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(g,h,i)perylene	0.0058	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Benzo(k)fluoranthene	0.0020	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Chrysene	0.0066	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Dibenz(a,h)anthracene	0.0013	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Fluoranthene	0.0049	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Fluorene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Indeno(1,2,3-cd)pyrene	0.0039	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Naphthalene	0.0031	0.0020	0.020	mg/kg	J	8270D-SI	09/30/13	1
Phenanthrene	0.0023	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Pyrene	0.0050	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
1-Methylnaphthalene	U	0.0020	0.020	mg/kg		8270D-SI	09/30/13	1
2-Methylnaphthalene	U	0.0020	0.020	mg/kg		8270D-SI	09/30/13	1
2-Chloronaphthalene	U	0.0020	0.020	mg/kg		8270D-SI	09/30/13	1
Surrogate Recovery								
Nitrobenzene-d5	94.2			% Rec.		8270D-SI	09/30/13	1
2-Fluorobiphenyl	95.6			% Rec.		8270D-SI	09/30/13	1
p-Terphenyl-d14	83.9			% Rec.		8270D-SI	09/30/13	1

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:09

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-04

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-4

Collected By : Paul Masten
Collection Date : 09/19/13 13:30

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	96.6	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	160	0.095	0.26	mg/kg		6010B	10/07/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.0021	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Acenaphthene	0.0037	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Acenaphthylene	0.00068	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Benzo(a)anthracene	0.0069	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(a)pyrene	0.0095	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(b)fluoranthene	0.012	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(g,h,i)perylene	0.0084	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(k)fluoranthene	0.0032	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Chrysene	0.010	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Dibenz(a,h)anthracene	0.0021	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Fluoranthene	0.016	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Fluorene	0.0016	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Indeno(1,2,3-cd)pyrene	0.0065	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Naphthalene	0.0033	0.0020	0.021	mg/kg	J	8270D-SI	09/30/13	1
Phenanthrene	0.012	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Pyrene	0.011	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
1-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Chloronaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
Surrogate Recovery								
Nitrobenzene-d5	92.4			% Rec.		8270D-SI	09/30/13	1
2-Fluorobiphenyl	95.7			% Rec.		8270D-SI	09/30/13	1
p-Terphenyl-d14	85.8			% Rec.		8270D-SI	09/30/13	1

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:09

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-05

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-5

Collected By : Paul Masten
Collection Date : 09/19/13 13:35

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	96.6	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	16.	0.095	0.26	mg/kg		6010B	10/07/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Acenaphthene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Acenaphthylene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(a)anthracene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(a)pyrene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(b)fluoranthene	0.00066	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Benzo(g,h,i)perylene	0.00097	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Benzo(k)fluoranthene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Chrysene	0.00072	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Dibenz(a,h)anthracene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Fluoranthene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Fluorene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Indeno(1,2,3-cd)pyrene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Naphthalene	0.0029	0.0020	0.021	mg/kg	J	8270D-SI	09/30/13	1
Phenanthrene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Pyrene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
1-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Chloronaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
Surrogate Recovery								
Nitrobenzene-d5	100.			% Rec.		8270D-SI	09/30/13	1
2-Fluorobiphenyl	93.6			% Rec.		8270D-SI	09/30/13	1
p-Terphenyl-d14	88.0			% Rec.		8270D-SI	09/30/13	1

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:09

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-06

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-6

Collected By : Paul Masten
Collection Date : 09/20/13 08:40

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	88.1	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	10000	0.095	0.28	mg/kg		6010B	10/07/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.022	0.0060	0.068	mg/kg	J	8270D-SI	09/30/13	10
Acenaphthene	U	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Acenaphthylene	0.0088	0.0060	0.068	mg/kg	J	8270D-SI	09/30/13	10
Benzo(a)anthracene	0.33	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Benzo(a)pyrene	0.49	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Benzo(b)fluoranthene	0.75	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Benzo(g,h,i)perylene	0.44	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Benzo(k)fluoranthene	0.24	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Chrysene	0.52	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Dibenz(a,h)anthracene	0.10	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Fluoranthene	0.95	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Fluorene	0.0069	0.0060	0.068	mg/kg	J	8270D-SI	09/30/13	10
Indeno(1,2,3-cd)pyrene	0.38	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Naphthalene	0.034	0.020	0.23	mg/kg	J	8270D-SI	09/30/13	10
Phenanthrene	0.22	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
Pyrene	0.56	0.0060	0.068	mg/kg		8270D-SI	09/30/13	10
1-Methylnaphthalene	U	0.020	0.23	mg/kg		8270D-SI	09/30/13	10
2-Methylnaphthalene	U	0.020	0.23	mg/kg		8270D-SI	09/30/13	10
2-Chloronaphthalene	U	0.020	0.23	mg/kg		8270D-SI	09/30/13	10
Surrogate Recovery								
Nitrobenzene-d5	71.8			% Rec.		8270D-SI	09/30/13	10
2-Fluorobiphenyl	81.4			% Rec.		8270D-SI	09/30/13	10
p-Terphenyl-d14	63.8			% Rec.		8270D-SI	09/30/13	10

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:09

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-07

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-7

Collected By : Paul Masten
Collection Date : 09/20/13 08:55

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	96.2	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	72000	0.95	2.6	mg/kg		6010B	10/07/13	10
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.023	0.0030	0.031	mg/kg	J	8270D-SI	09/30/13	5
Acenaphthene	0.0066	0.0030	0.031	mg/kg	J	8270D-SI	09/30/13	5
Acenaphthylene	U	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Benzo(a)anthracene	0.11	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Benzo(a)pyrene	0.18	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Benzo(b)fluoranthene	0.21	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Benzo(g,h,i)perylene	0.14	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Benzo(k)fluoranthene	0.073	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Chrysene	0.17	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Dibenz(a,h)anthracene	0.033	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Fluoranthene	0.19	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Fluorene	0.0052	0.0030	0.031	mg/kg	J	8270D-SI	09/30/13	5
Indeno(1,2,3-cd)pyrene	0.11	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Naphthalene	0.010	0.010	0.10	mg/kg	J	8270D-SI	09/30/13	5
Phenanthrene	0.066	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
Pyrene	0.14	0.0030	0.031	mg/kg		8270D-SI	09/30/13	5
1-Methylnaphthalene	U	0.010	0.10	mg/kg		8270D-SI	09/30/13	5
2-Methylnaphthalene	U	0.010	0.10	mg/kg		8270D-SI	09/30/13	5
2-Chloronaphthalene	U	0.010	0.10	mg/kg		8270D-SI	09/30/13	5
Surrogate Recovery								
Nitrobenzene-d5	80.9			% Rec.		8270D-SI	09/30/13	5
2-Fluorobiphenyl	93.8			% Rec.		8270D-SI	09/30/13	5
p-Terphenyl-d14	76.2			% Rec.		8270D-SI	09/30/13	5

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:09

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-08

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-8

Collected By : Paul Masten
Collection Date : 09/20/13 09:40

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	97.5	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	12000	0.48	1.3	mg/kg		6010B	10/07/13	5
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.020	0.0060	0.062	mg/kg	J	8270D-SI	09/30/13	10
Acenaphthene	0.0062	0.0060	0.062	mg/kg	J	8270D-SI	09/30/13	10
Acenaphthylene	U	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Benzo(a)anthracene	0.28	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Benzo(a)pyrene	0.41	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Benzo(b)fluoranthene	0.64	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Benzo(g,h,i)perylene	0.40	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Benzo(k)fluoranthene	0.20	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Chrysene	0.45	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Dibenz(a,h)anthracene	0.090	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Fluoranthene	0.76	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Fluorene	0.0062	0.0060	0.062	mg/kg	J	8270D-SI	09/30/13	10
Indeno(1,2,3-cd)pyrene	0.34	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Naphthalene	U	0.020	0.20	mg/kg		8270D-SI	09/30/13	10
Phenanthrene	0.17	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
Pyrene	0.47	0.0060	0.062	mg/kg		8270D-SI	09/30/13	10
1-Methylnaphthalene	U	0.020	0.20	mg/kg		8270D-SI	09/30/13	10
2-Methylnaphthalene	U	0.020	0.20	mg/kg		8270D-SI	09/30/13	10
2-Chloronaphthalene	U	0.020	0.20	mg/kg		8270D-SI	09/30/13	10
Surrogate Recovery								
Nitrobenzene-d5	79.3			% Rec.		8270D-SI	09/30/13	10
2-Fluorobiphenyl	88.0			% Rec.		8270D-SI	09/30/13	10
p-Terphenyl-d14	75.1			% Rec.		8270D-SI	09/30/13	10

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:09

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-09

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-9

Collected By : Paul Masten
Collection Date : 09/20/13 09:20

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	95.7	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	160	0.095	0.26	mg/kg		6010B	10/07/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	U	0.00060	0.0063	mg/kg		8270D-SI	09/30/13	1
Acenaphthene	U	0.00060	0.0063	mg/kg		8270D-SI	09/30/13	1
Acenaphthylene	U	0.00060	0.0063	mg/kg		8270D-SI	09/30/13	1
Benzo(a)anthracene	0.0012	0.00060	0.0063	mg/kg	J	8270D-SI	09/30/13	1
Benzo(a)pyrene	0.0017	0.00060	0.0063	mg/kg	J	8270D-SI	09/30/13	1
Benzo(b)fluoranthene	0.0018	0.00060	0.0063	mg/kg	J	8270D-SI	09/30/13	1
Benzo(g,h,i)perylene	0.0014	0.00060	0.0063	mg/kg	J	8270D-SI	09/30/13	1
Benzo(k)fluoranthene	U	0.00060	0.0063	mg/kg		8270D-SI	09/30/13	1
Chrysene	0.0012	0.00060	0.0063	mg/kg	J	8270D-SI	09/30/13	1
Dibenz(a,h)anthracene	U	0.00060	0.0063	mg/kg		8270D-SI	09/30/13	1
Fluoranthene	0.0016	0.00060	0.0063	mg/kg	J	8270D-SI	09/30/13	1
Fluorene	U	0.00060	0.0063	mg/kg		8270D-SI	09/30/13	1
Indeno(1,2,3-cd)pyrene	0.00094	0.00060	0.0063	mg/kg	J	8270D-SI	09/30/13	1
Naphthalene	0.0027	0.0020	0.021	mg/kg	J	8270D-SI	09/30/13	1
Phenanthrene	0.00063	0.00060	0.0063	mg/kg	J	8270D-SI	09/30/13	1
Pyrene	0.0015	0.00060	0.0063	mg/kg	J	8270D-SI	09/30/13	1
1-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Chloronaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
Surrogate Recovery								
Nitrobenzene-d5	88.4			% Rec.		8270D-SI	09/30/13	1
2-Fluorobiphenyl	88.5			% Rec.		8270D-SI	09/30/13	1
p-Terphenyl-d14	74.5			% Rec.		8270D-SI	09/30/13	1

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:09

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-10

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-10

Collected By : Paul Masten
Collection Date : 09/20/13 10:05

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	96.8	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	5700	0.095	0.26	mg/kg		6010B	10/07/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.0037	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Acenaphthene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Acenaphthylene	0.0018	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Benzo(a)anthracene	0.014	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(a)pyrene	0.023	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(b)fluoranthene	0.031	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(g,h,i)perylene	0.015	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(k)fluoranthene	0.0086	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Chrysene	0.024	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Dibenz(a,h)anthracene	0.0046	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Fluoranthene	0.015	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Fluorene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Indeno(1,2,3-cd)pyrene	0.011	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Naphthalene	0.0034	0.0020	0.021	mg/kg	J	8270D-SI	09/30/13	1
Phenanthrene	0.0033	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Pyrene	0.016	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
1-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Chloronaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
Surrogate Recovery								
Nitrobenzene-d5	85.8			% Rec.		8270D-SI	09/30/13	1
2-Fluorobiphenyl	82.6			% Rec.		8270D-SI	09/30/13	1
p-Terphenyl-d14	76.8			% Rec.		8270D-SI	09/30/13	1

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:10

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-11

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-11

Collected By : Paul Masten
Collection Date : 09/20/13 10:20

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	94.3	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	29000	0.48	1.3	mg/kg		6010B	10/07/13	5
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.049	0.0060	0.064	mg/kg	J	8270D-SI	09/30/13	10
Acenaphthene	0.017	0.0060	0.064	mg/kg	J	8270D-SI	09/30/13	10
Acenaphthylene	0.013	0.0060	0.064	mg/kg	J	8270D-SI	09/30/13	10
Benzo(a)anthracene	0.30	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Benzo(a)pyrene	0.50	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Benzo(b)fluoranthene	0.64	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Benzo(g,h,i)perylene	0.41	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Benzo(k)fluoranthene	0.24	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Chrysene	0.44	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Dibenz(a,h)anthracene	0.099	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Fluoranthene	0.55	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Fluorene	0.0082	0.0060	0.064	mg/kg	J	8270D-SI	09/30/13	10
Indeno(1,2,3-cd)pyrene	0.34	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Naphthalene	U	0.020	0.21	mg/kg		8270D-SI	09/30/13	10
Phenanthrene	0.13	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
Pyrene	0.38	0.0060	0.064	mg/kg		8270D-SI	09/30/13	10
1-Methylnaphthalene	U	0.020	0.21	mg/kg		8270D-SI	09/30/13	10
2-Methylnaphthalene	U	0.020	0.21	mg/kg		8270D-SI	09/30/13	10
2-Chloronaphthalene	U	0.020	0.21	mg/kg		8270D-SI	09/30/13	10
Surrogate Recovery								
Nitrobenzene-d5	60.7			% Rec.		8270D-SI	09/30/13	10
2-Fluorobiphenyl	78.3			% Rec.		8270D-SI	09/30/13	10
p-Terphenyl-d14	67.1			% Rec.		8270D-SI	09/30/13	10

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:10

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08,2013

ESC Sample # : L658895-12

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-12

Collected By : Paul Masten
Collection Date : 09/20/13 10:42

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	89.4	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	260	0.095	0.28	mg/kg		6010B	10/07/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.00068	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Acenaphthene	U	0.00060	0.0067	mg/kg		8270D-SI	09/30/13	1
Acenaphthylene	U	0.00060	0.0067	mg/kg		8270D-SI	09/30/13	1
Benzo(a)anthracene	0.0041	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Benzo(a)pyrene	0.0051	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Benzo(b)fluoranthene	0.0076	0.00060	0.0067	mg/kg		8270D-SI	09/30/13	1
Benzo(g,h,i)perylene	0.0036	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Benzo(k)fluoranthene	0.0019	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Chrysene	0.0058	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Dibenz(a,h)anthracene	0.00097	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Fluoranthene	0.0054	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Fluorene	U	0.00060	0.0067	mg/kg		8270D-SI	09/30/13	1
Indeno(1,2,3-cd)pyrene	0.0028	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Naphthalene	0.0026	0.0020	0.022	mg/kg	J	8270D-SI	09/30/13	1
Phenanthrene	0.0010	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
Pyrene	0.0047	0.00060	0.0067	mg/kg	J	8270D-SI	09/30/13	1
1-Methylnaphthalene	U	0.0020	0.022	mg/kg		8270D-SI	09/30/13	1
2-Methylnaphthalene	U	0.0020	0.022	mg/kg		8270D-SI	09/30/13	1
2-Chloronaphthalene	U	0.0020	0.022	mg/kg		8270D-SI	09/30/13	1
Surrogate Recovery								
Nitrobenzene-d5	86.5			% Rec.		8270D-SI	09/30/13	1
2-Fluorobiphenyl	89.5			% Rec.		8270D-SI	09/30/13	1
p-Terphenyl-d14	83.0			% Rec.		8270D-SI	09/30/13	1

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:10

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08, 2013

ESC Sample # : L658895-13

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : S-13

Collected By : Paul Masten
Collection Date : 09/20/13 11:01

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	96.9	0.0333	0.100	%		2540 G-2	09/26/13	1
Lead	240	0.095	0.26	mg/kg		6010B	10/07/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.0047	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Acenaphthene	0.0057	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Acenaphthylene	U	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(a)anthracene	0.033	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(a)pyrene	0.055	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(b)fluoranthene	0.058	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(g,h,i)perylene	0.036	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Benzo(k)fluoranthene	0.018	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Chrysene	0.037	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Dibenz(a,h)anthracene	0.010	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Fluoranthene	0.034	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Fluorene	0.0012	0.00060	0.0062	mg/kg	J	8270D-SI	09/30/13	1
Indeno(1,2,3-cd)pyrene	0.031	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Naphthalene	0.0040	0.0020	0.021	mg/kg	J	8270D-SI	09/30/13	1
Phenanthrene	0.011	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
Pyrene	0.028	0.00060	0.0062	mg/kg		8270D-SI	09/30/13	1
1-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Methylnaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
2-Chloronaphthalene	U	0.0020	0.021	mg/kg		8270D-SI	09/30/13	1
Surrogate Recovery								
Nitrobenzene-d5	94.4			% Rec.		8270D-SI	09/30/13	1
2-Fluorobiphenyl	90.5			% Rec.		8270D-SI	09/30/13	1
p-Terphenyl-d14	71.9			% Rec.		8270D-SI	09/30/13	1

Results listed are dry weight basis.
U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
This report shall not be reproduced, except in full, without the written approval from ESC.
The reported analytical results relate only to the sample submitted
Reported: 10/08/13 09:09 Printed: 10/08/13 09:10

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Paul Masten
S&ME Inc. - Wilmington, NC
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

October 08, 2013

ESC Sample # : L658895-14

Site ID : WILMINGTON, NC

Project # : 1054-13-309

Date Received : September 21, 2013
Description : CFPUA Firing Range

Sample ID : GW-01

Collected By : Paul Masten
Collection Date : 09/19/13 13:00

Parameter	Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Lead	0.0025	0.0019	0.0050	mg/l	J	6010B	10/03/13	1
Polynuclear Aromatic Hydrocarbons								
Anthracene	U	0.000013	0.000050	mg/l		8270 D-	09/26/13	1
Acenaphthene	U	0.0000082	0.000050	mg/l		8270 D-	09/26/13	1
Acenaphthylene	U	0.000011	0.000050	mg/l		8270 D-	09/26/13	1
Benzo(a)anthracene	U	0.000012	0.000050	mg/l		8270 D-	09/26/13	1
Benzo(a)pyrene	U	0.000016	0.000050	mg/l		8270 D-	09/26/13	1
Benzo(b)fluoranthene	U	0.000019	0.000050	mg/l		8270 D-	09/26/13	1
Benzo(g,h,i)perylene	U	0.000016	0.000050	mg/l		8270 D-	09/26/13	1
Benzo(k)fluoranthene	U	0.000026	0.000050	mg/l		8270 D-	09/26/13	1
Chrysene	U	0.000014	0.000050	mg/l		8270 D-	09/26/13	1
Dibenz(a,h)anthracene	U	0.0000045	0.000050	mg/l		8270 D-	09/26/13	1
Fluoranthene	U	0.000016	0.000050	mg/l		8270 D-	09/26/13	1
Fluorene	U	0.0000090	0.000050	mg/l		8270 D-	09/26/13	1
Indeno(1,2,3-cd)pyrene	U	0.0000074	0.000050	mg/l		8270 D-	09/26/13	1
Naphthalene	0.000079	0.000012	0.00025	mg/l	J	8270 D-	09/26/13	1
Phenanthrene	U	0.000018	0.000050	mg/l		8270 D-	09/26/13	1
Pyrene	U	0.000016	0.000050	mg/l		8270 D-	09/26/13	1
1-Methylnaphthalene	U	0.000019	0.00025	mg/l		8270 D-	09/26/13	1
2-Methylnaphthalene	0.000022	0.000016	0.00025	mg/l	J	8270 D-	09/26/13	1
2-Chloronaphthalene	U	0.000016	0.00025	mg/l		8270 D-	09/26/13	1
Surrogate Recovery								
Nitrobenzene-d5	72.6			% Rec.		8270 D-	09/26/13	1
2-Fluorobiphenyl	82.8			% Rec.		8270 D-	09/26/13	1
p-Terphenyl-d14	88.0			% Rec.		8270 D-	09/26/13	1

U = ND (Not Detected)
MDL = Minimum Detection Limit = LOD = TRRP SDL
RDL = Reported Detection Limit = LOQ = PQL = EQL = TRRP MQL
Note:
The reported analytical results relate only to the sample submitted.
This report shall not be reproduced, except in full, without the written approval from ESC.
.
Reported: 10/08/13 09:09 Printed: 10/08/13 09:10

Attachment A
List of Analytes with QC Qualifiers

Sample Number	Work Group	Sample Type	Analyte	Run ID	Qualifier
L658895-01	WG684407	SAMP	Benzo(b)fluoranthene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
L658895-02	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Acenaphthene	R2831203	J
	WG684407	SAMP	Dibenz(a,h)anthracene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
	WG684407	SAMP	Phenanthrene	R2831203	J
L658895-03	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Benzo(a)anthracene	R2831203	J
	WG684407	SAMP	Benzo(g,h,i)perylene	R2831203	J
	WG684407	SAMP	Benzo(k)fluoranthene	R2831203	J
	WG684407	SAMP	Dibenz(a,h)anthracene	R2831203	J
	WG684407	SAMP	Fluoranthene	R2831203	J
	WG684407	SAMP	Indeno(1,2,3-cd)pyrene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
	WG684407	SAMP	Phenanthrene	R2831203	J
	WG684407	SAMP	Pyrene	R2831203	J
L658895-04	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Acenaphthene	R2831203	J
	WG684407	SAMP	Acenaphthylene	R2831203	J
	WG684407	SAMP	Benzo(k)fluoranthene	R2831203	J
	WG684407	SAMP	Dibenz(a,h)anthracene	R2831203	J
	WG684407	SAMP	Fluorene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
L658895-05	WG684407	SAMP	Benzo(b)fluoranthene	R2831203	J
	WG684407	SAMP	Benzo(g,h,i)perylene	R2831203	J
	WG684407	SAMP	Chrysene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
L658895-06	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Acenaphthylene	R2831203	J
	WG684407	SAMP	Fluorene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
L658895-07	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Acenaphthene	R2831203	J
	WG684407	SAMP	Fluorene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
L658895-08	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Acenaphthene	R2831203	J
	WG684407	SAMP	Fluorene	R2831203	J
L658895-09	WG684407	SAMP	Benzo(a)anthracene	R2831203	J
	WG684407	SAMP	Benzo(a)pyrene	R2831203	J
	WG684407	SAMP	Benzo(b)fluoranthene	R2831203	J
	WG684407	SAMP	Benzo(g,h,i)perylene	R2831203	J
	WG684407	SAMP	Chrysene	R2831203	J
	WG684407	SAMP	Fluoranthene	R2831203	J
	WG684407	SAMP	Indeno(1,2,3-cd)pyrene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
	WG684407	SAMP	Phenanthrene	R2831203	J
	WG684407	SAMP	Pyrene	R2831203	J
L658895-10	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Acenaphthylene	R2831203	J
	WG684407	SAMP	Dibenz(a,h)anthracene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
	WG684407	SAMP	Phenanthrene	R2831203	J
L658895-11	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Acenaphthene	R2831203	J
	WG684407	SAMP	Acenaphthylene	R2831203	J
	WG684407	SAMP	Fluorene	R2831203	J
L658895-12	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Benzo(a)anthracene	R2831203	J
	WG684407	SAMP	Benzo(a)pyrene	R2831203	J
	WG684407	SAMP	Benzo(g,h,i)perylene	R2831203	J
	WG684407	SAMP	Benzo(k)fluoranthene	R2831203	J
	WG684407	SAMP	Chrysene	R2831203	J
	WG684407	SAMP	Dibenz(a,h)anthracene	R2831203	J
	WG684407	SAMP	Fluoranthene	R2831203	J
	WG684407	SAMP	Indeno(1,2,3-cd)pyrene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
	WG684407	SAMP	Phenanthrene	R2831203	J

Attachment A
List of Analytes with QC Qualifiers

Sample Number	Work Group	Sample Type	Analyte	Run ID	Qualifier
	WG684407	SAMP	Pyrene	R2831203	J
L658895-13	WG684407	SAMP	Anthracene	R2831203	J
	WG684407	SAMP	Acenaphthene	R2831203	J
	WG684407	SAMP	Fluorene	R2831203	J
	WG684407	SAMP	Naphthalene	R2831203	J
L658895-14	WG683544	SAMP	Naphthalene	R2827366	J
	WG683544	SAMP	2-Methylnaphthalene	R2827366	J
	WG683863	SAMP	Lead	R2834741	J

Attachment B
Explanation of QC Qualifier Codes

Qualifier	Meaning
J	(EPA) - Estimated value below the lowest calibration point. Confidence correlates with concentration.

Qualifier Report Information

ESC utilizes sample and result qualifiers as set forth by the EPA Contract Laboratory Program and as required by most certifying bodies including NELAC. In addition to the EPA qualifiers adopted by ESC, we have implemented ESC qualifiers to provide more information pertaining to our analytical results. Each qualifier is designated in the qualifier explanation as either EPA or ESC. Data qualifiers are intended to provide the ESC client with more detailed information concerning the potential bias of reported data. Because of the wide range of constituents and variety of matrices incorporated by most EPA methods,it is common for some compounds to fall outside of established ranges. These exceptions are evaluated and all reported data is valid and useable "unless qualified as 'R' (Rejected)."

Definitions

Accuracy - The relationship of the observed value of a known sample to the true value of a known sample. Represented by percent recovery and relevant to samples such as: control samples, matrix spike recoveries, surrogate recoveries, etc.

Precision - The agreement between a set of samples or between duplicate samples. Relates to how close together the results are and is represented by Relative Percent Differrence.

Surrogate - Organic compounds that are similar in chemical composition, extraction, and chromotography to analytes of interest. The surrogates are used to determine the probable response of the group of analytes that are chemically related to the surrogate compound. Surrogates are added to the sample and carried through all stages of preparation and analyses.

TIC - Tentatively Identified Compound: Compounds detected in samples that are not target compounds, internal standards, system monitoring compounds, or surrogates.

Summary of Remarks For Samples Printed
10/08/13 at 09:10:03

TSR Signing Reports: 350
R5 - Desired TAT

MDL/RDL

Sample: L658895-01 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09
Refer to hold label 09-0055
Sample: L658895-02 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-03 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-04 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-05 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-06 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-07 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-08 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-09 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-10 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-11 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-12 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-13 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

Sample: L658895-14 Account: SMEWNC Received: 09/21/13 09:00 Due Date: 09/27/13 00:00 RPT Date: 10/08/13 09:09

S&ME Inc. - Wilmington, NC

3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

Billing Information:
Paul Masten
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

Report to: **Paul Masten**

Email To: **pmasten@smeinc.com**

Project Description: **CFPUA Firing Range**

City/State Collected: Wilmington, NC

Phone: **910-799-9945**
Fax:

Client Project # **1054-13-309**

Lab Project # **SMEWNC-1054-13-309**

Collected by (print): PAUL MASTEN

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day 200%
___ Next Day 100%
___ Two Day 50%
___ Three Day 25%

Date Results Needed

Email? ___No X_Yes
FAX? ___No ___Yes

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	8270PAHSIMD 100ml Amb-NoPres	PBICP 2ozClr-NoPres	PBICP 500mlHDPE-HNO3	SV8270PAHSIMD 4ozAmb-NoPres	TS 2ozClr-NoPres					Rem./Contaminant	Sample # (lab only)
S-1	Comp	SS		9/19/13	10:05	3		X		X	X						-01
S-2	↓	SS		↓	10:44	3		X		X	X						-02
S-3		SS			11:20	3		X		X	X						-03
S-4		SS			1:30	3		X		X	X						-04
S-5		SS		↓	1:35	3		X		X	X						-05
S-6		SS		9/20/13	8:40	3		X		X	X						-06
S-7		SS			8:55	3		X		X	X						-07
S-8		SS			9:40	3		X		X	X						-08
S-9		SS			9:20	3		X		X	X						-09
S-10	↓	SS		↓	10:05	3		X		X	X						-10

* Matrix: **SS** - Soil **GW** - Groundwater **WW** - WasteWater **DW** - Drinking Water **OT** - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Chain of Custody Page 1 of 2

ESC LABORATORY SCIENCES
YOUR LAB OF CHOICE
12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# 658695

D216

Acctnum: **SMEWNC**
Template: **T89120**
Prelogin: **P443122**
TSR: **350 - Jimmy Hunt**
PB: 9.12 MS
Shipped Via: **FedEx Ground**

5704605925 49

Hold # **09-0055**

Condition: (lab use only)

COC Seal Intact: ___Y ___N ✓NA

pH Checked: NCF:

Samples returned via: ☐ UPS ☑ FedEx ☐ Courier ☐ _____

Temp: 3.9 °C Bottles Received: 51

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
	9/20/13	2:00	
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)
			Date: 09/21/13 Time: 0900

S&ME Inc. - Wilmington, NC

3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

Billing Information:
Paul Masten
3006 Hall Waters Drive Suite 100
Wilmington, NC 28405

Report to: Paul Masten

Email To: pmasten@smeinc.com

Project Description: CFPUA Firing Range

City/State Collected:

Phone: 910-799-9945
Fax:

Client Project # 1054-13-309

Lab Project # SMEWNC-1054-13-309

Collected by (print): PAUL MASTEN

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day 200%
___ Next Day 100%
___ Two Day 50%
___ Three Day 25%

Date Results Needed

Email? ___No X Yes
FAX? ___No ___Yes

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	8270PAHSIMD 100ml Amb-NoPres	PBICP 2ozClr-NoPres	PBICP 500mlHDPE-HNO3	SV8270PAHSIMD 4ozAmb-NoPres	TS 2ozClr-NoPres	Rem./Contaminant	Sample # (lab only)
S-11	Comp	SS		9/20/13	10:20	3		X		X	X		-11
S-12	↓	SS		↓	10:42	3		X		X	X		-12
S-13		SS			11:01	3		X		X	X		-13
S-14 HOLD		SS			11:17	3		X		X	X	(JF)	~~-14~~
S-15 HOLD	↓	SS		↓	11:29	3		X		X	X		
GW-01	Grab	GW		9-19-13	1300	3	X		X				-14
~~GW-02~~		GW				3	X		X				
S-16 HOLD	G	SS		9/20/13	11:43	3		X		X	X		
S-17 HOLD	↓	SS		9/19/13	1:30	3		X		X	X		

* Matrix: SS - Soil GW - Groundwater WW - WasteWater DW - Drinking Water OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Analysis / Container / Preservative

Chain of Custody Page 2 of 2

ESC LABS

YOUR LAB OF CHOICE

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# 658895

Table #

Acctnum: SMEWNC

Template: T89120

Prelogin: P443122

TSR: 350 - Jimmy Hunt

PB: 9.12 MS

Shipped Via: FedEX Ground

5104605 92549

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
	9/20/13	2:00	
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)

Samples returned via: ☐ UPS ☑ FedEx ☐ Courier ☐ _____

Temp: 3.9 °C Bottles Received: 54

Date: 09/21/13 Time: 0900

Hold #

Condition: 5 (lab use only)

COC Seal Intact: ___Y ___N ___NA

pH Checked: NCF:

Appendix L

City of Wilmington Code of Ordinances

Article 2. Zoning Districts

ARTICLE 2.
ZONING DISTRICTS

ARTICLE 2. DIVISION 1.

ZONING DISTRICTS, MAP, AND USES

Section 18-16: Districts established

To regulate the height and size of buildings, the intensity of land usage, areas for open space, the location of land uses; provide for an improved environment; and promote the health, safety, and general welfare of its citizens, the city of Wilmington is hereby divided into the zoning districts described in this article.

Section 18-17: Conformity required

A. No land, building, or structure shall be used or occupied, and no building or structure, in whole or part, shall be constructed, erected, altered, or moved unless in conformity with all the regulations for the district within which it is located, except as otherwise specified in this chapter.

B. A use or building expressly permitted by right, with use-specific standards, or by special use permit shall be allowed in a zoning district.

C. Those uses identified as prohibited in reasonably expressed terms provide notice that those uses shall not be allowed unless such use is permitted in accordance with article 7, division 4 of this chapter.

D. An unidentified use not addressed in this chapter where an owner is not on notice that a particular use is prohibited or otherwise regulated shall be liberally construed in favor of the landowner.

Section 18-18: Official zoning map

A. Boundaries

The boundaries of the zoning districts established herein are shown on the official zoning map of the city that is incorporated by reference into this chapter. The official zoning map shall be maintained by the city clerk in digital and printed records and shall be available for viewing on the city of Wilmington website.

B. Amendments

If, in accordance with the provisions of this chapter, changes are made in district boundaries or other references on the official zoning map, such changes shall be entered on the official zoning map within seven working days after the amendment has been approved by the city council. No changes of any nature shall be made on the official zoning map except in conformity with the procedures set forth in Article 7, Administrative Provisions.

C. Rules for Interpretation of District Boundaries

The zoning administrator shall determine the exact location of any zoning district boundary lines whenever uncertainty exists about the boundary lines shown on the official zoning map. Such determination shall be subject to appeal to the board of adjustment. The determination of the exact location of a zoning district boundary shall be based upon the following standards:

1. The zoning of a lot shall extend to the centerline of all streets to which that lot abuts. On corner lots, the zoning shall extend to the center point of the intersection.

2. For boundaries indicated as approximately following or within a street, alley, or railroad right-of-way, or utilities (electrical, gas, water main, etc.) easement, the boundary shall be construed to be in the center of such right-of-way or easement.

3. Boundaries indicated as following shorelines or mean high water lines shall be construed to follow such shorelines or the mean high water lines, and in the event of change in the shorelines, shall be construed as moving with the actual shoreline. Boundaries indicated as approximately following the centerlines of streams, rivers, creeks, or other bodies of water shall be construed as following such centerlines.

4. Boundaries indicated as approximately following plotted lot lines shall be construed as following such lot lines

5. Boundaries indicated as approximately following city limits shall be construed as following city limits.

6. Boundaries indicated as parallel to or extension of features indicated in subsections 1-5 above shall be so construed.

Section 18-19: Uses

A. Organization

Each of the categories of zoning districts in this article includes a use table keyed to the districts in that specific division. In the various use tables, land uses and activities are classified into general use classes of residential, civic and institutional, commercial, and industrial. The use tables in each of the zoning categories generally indicate uses permitted in the applicable zoning districts and are not exhaustive lists of uses. A full use table, inclusive of all principal uses permitted in the city, is located in Table 18-9.2: Universal use table.

B. Use-Specific Standards

In addition to allocating uses to zoning districts, the use tables also identify when additional standards are applicable to the use. No person shall change or commence principal use of any building or land, except the use of land for agricultural purposes, until a zoning permit has been issued by the city manager stating that the proposed use complies with the provisions of this chapter. Compliance with applicable standards will be determined through the appropriate compliance review.

C. Explanation of Table Abbreviations

1. Uses permitted by right

   A “P” in a cell indicates the use is permitted by right in the district. Permitted uses are subject to all other applicable standards of this chapter.

2. Uses permitted by prescribed conditions

   A “C” in a cell indicates the use is allowed only if it complies with applicable standards of this chapter, including use-specific standards in Article 3.

3. Uses permitted by special use permit

   An “S” in a cell indicates the use is allowed only if reviewed and approved as a special use in accordance with the procedures of Section 18-589: Special use permits. Special uses are subject to all other applicable standards of this code, including Article 3.

4. Prohibited Uses

   A blank cell indicates that the use is prohibited in the district.

D. Zoning Permit Required

1. New uses and changes of use

   All new uses and changes of use shall require the issuance of a zoning permit. If a use complies with the applicable standards for that use, that use shall be approved. No other uses may be

substituted without a new review and approval process.

2. Change of Use

   a. The following shall be considered a change of use, for which a new zoning permit is required and for which conformance with the applicable standards of this chapter shall be required:

      i. Any new use that increases the prescribed site development requirements, e.g., landscaping, transitional buffers, parking lot landscaping, etc.;

      ii. Discontinuance or abandonment of a use for more than 180 days; and

      iii. From one use to another use, if it is the sole use of the premises.

   b. The following shall not be considered a change of use and no new zoning permit shall be required:

      i. Commercial use to a group home; and

      ii. Any permitted use as a part of a strip mall or multi-tenant commercial development.

E. Uses permitted in multiple districts with different standards

On a lot that has multiple zoning districts, uses shall comply with the standards for the zoning district in which they are located.

F. Use of dwelling units

Where residential uses are permitted, they shall be within a dwelling unit or mobile home, as defined in this chapter and permitted within the applicable zoning district. Any group living uses, as defined in this chapter, and nonresidential uses permitted within dwelling units shall be distinguished as uses by the definitions found in Article 8. Measurements and definitions and shall be regulated by the applicable standards.

G. Use Interpretations

The purpose of the use interpretation procedures is to provide a process for an applicant to request documentation regarding the meaning of the language in this article, the boundaries of the official zoning map, or conditions of an approval.

1. Interpretation types

   a. Formal interpretations shall be in writing and prepared in accordance with this section. Only formal interpretations are subject to appeal as an administrative decision.

   b. Any oral or written interpretations that do not meet the requirements of this section are considered advisory interpretations, which shall not have any binding effect and are not considered administrative decisions subject to appeal.

   c. Uses shall not be interpreted to be within more than one use category.

   d. Where the zoning administrator determines more than one use could apply, the owner shall select the applicable use category to be applied

2. Interpretation procedure

   The interpretation procedure is illustrated in Table 18-19.1. Interpretation procedure.

3. Interpretation standards

   a. Interpretation of official zoning map boundaries shall be in

accordance with the interpretation procedure in Table 18-19.1: Interpretation procedure.

b. Unlisted uses: Interpretation of whether an unlisted use is categorized with a use identified in Table 18-19.2 Universal use table shall be based on the following standards:

   i. Whether the unlisted use is the same or substantially similar to an existing listed use, thereby rendering the same listed use;

   ii. Interpretation of existing case law;

   iii. The function, product, or physical characteristics of the proposed use;

   iv. The impact created by the proposed use on adjacent uses;

   v. The type, scale, and nature of the buildings and structures associated with the proposed use;

   vi. The type of sale (retail, wholesale), if any, and the size and type of items sold and displayed on the premises;

   vii. The types of items stored (e.g., vehicles, chemicals, construction materials, scrap, raw materials, etc.), if any, on the premises;

   viii. The volume and type of vehicle traffic generated by the proposed use, including deliveries and parking demands;

   ix. Any processing associated with the proposed use, including assembly, manufacturing, warehousing, shipping, distribution, and whether it occurs indoors or outdoors;

   x. Any dangerous, hazardous, toxic, or explosive materials associated with the proposed use.

Figure 18-19.1: Use Interpretation procedure

Step 1 **FILE APPLICATION**

- File application with zoning administrator
- Incomplete applications shall be rejected
- Pay applicable fee

Step 2 **STAFF REVIEW AND DECISION**

- The zoning administrator shall conduct necessary research
- The zoning administrator may consult with other staff, including the city attorney
- The zoning administrator shall render a decision

Step 3 **NOTIFICATION OF DECISION**

- Formal interpretations shall be issued in writing
- Delivered via mail, electronic mail, or collected in person by applicant

xi. The amount and nature of any nuisances generated by the proposed use, including, but not limited, to noise, odors, smoke, glare, vibration, radiation, and fumes; and

xii. Any prior applicable interpretations made or decisions made by the board of adjustment.

c. If a term in this chapter is undefined or the meaning is unclear, the zoning administrator shall interpret the term based upon appropriate definitions in any of the following sources:

i. North Carolina General Statues;

ii. Applicable case law and changes thereto;

iii. North Carolina Administrative Code;

iv. North Carolina State Building Code , or its successor, as approved by the state of North Carolina;

v. Black's Law Dictionary;

vi. The Oxford Dictionary of Construction, Surveying, and Civil Engineering;

vii. Planning-related definitions in publications prepared or offered by the American Planning Association or the Urban Land Institute; and

viii. Other professionally accepted sources.

d. In cases where the zoning administrator determines the use category or use type in which the unlisted use is best classified, the unlisted use shall be subject to all applicable requirements of that category or use type for the zoning district in which the use is proposed.

4. Effect of Use Interpretation

a. General

An interpretation shall be binding on subsequent decisions by the zoning administrator in applying the same provision of this chapter or the official zoning map in the same circumstance, unless the interpretation is modified as the result of a zoning map or code amendment, the interpretation is later determined to have been made in error, or the text of the ordinance is amended.

b. The zoning administrator shall maintain a written record of interpretations that shall be available for public inspection, on reasonable request, during normal business hours.

c. Approval of Unlisted Use

i. After making a determination that a use is unlisted, the zoning administrator shall interpret the use to be allowed. The zoning administrator shall determine if the unlisted use is likely to be a common use or recur frequently, and, if so, shall initiate a code amendment, pursuant to the requirements found in Sec. 18-587: Land development code amendment. Until final action is taken on the code amendment, the zoning administrator's interpretation shall be binding.

ii. If the zoning administrator determines that the unlisted use is of an unusual or transitory nature, and unlikely to recur frequently, the determination shall be binding without further action or amendment of this chapter. This shall not be construed to prohibit the zoning administrator, the city council, or another applicant from submitting a code amendment application relative to the use in question after the initial use interpretation has been made.

H. Uses prohibited everywhere

The following uses are not listed in Table 18-19.2. Universal use table, and are prohibited throughout the city:

1. Agricultural uses
    a. Concentrated animal feeding operation (CAFO)
    b. Slaughterhouses
2. Commercial uses
    a. Outdoor shooting ranges
    b. Portable storage containers as permanent storage facilities
    c. The use of a travel trailer or recreational vehicle for business or office purposes
3. Industrial uses
    a. Fracking
    b. Junkyard or salvage yard
    c. Landfill
    d. Ordinance manufacturing
    e. Pulp and paper products manufacturing
    f. Processing or storage of radioactive or infectious waste
    g. Solid waste transfer facility
    h. Power generating plants
4. Residential uses
    a. Use of a boat, houseboat, or other floating structure as temporary or permanent residence or short-term lodging (this shall not prevent the overnight occupancy of a vessel temporarily moored while in transit on navigable waters)
    b. Use of a travel trailer, recreational vehicle, or other such vehicle as a permanent or temporary residence, except as permitted by article 3, division 4 of this chapter.

I. Universal use table

Table 18-19.2: Universal use table, lists all uses permitted in each zoning district within the city. In the event of a conflict between the use tables within each of the zoning district groups and Table 18-19.2, Table 18-19.2 shall prevail.

Table 18-19.2: Universal use table

Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited

Principal use	Additional standards	R-15	R-10	R-7	R-5	R-3	MD-10	MD-17	MH	UMX	RO	CBD
Civic and institutional												
Assembly	Section 18-126											
Civic club or lodge, private										P		P
Community center												
Building footprint up to 5,000 sq. ft.		S	S	S	S	S	S	S	S	C		P
Building footprint greater than 5,000 sq. ft.							S	S		C		P
With outdoor facilities		S	S	S	S	S	S	S	S	C		P
Entertainment and trade										C		P
Religious		C	C	C	C	C	C	C	C	C		P
Chemical dependency treatment facility										P		
Community garden	Section 18-134	C	C	C	C	C	C	C	C	C	C	C
Correctional facility	Section 18-137											
Daycare, adult or child	Section 18-138	C	C	C	C	C	C	C		C		C
Domestic violence shelter	Section 18-139	C	C	C	C	C	C	C		P	P	P
Dormitory, fraternity, or sorority house	Section 18-140						S	S		S		C
Government facilities excluding of rights-of-way	Section 18-148	C	C	C	C	C	C	C	C	P		P
Hospital	Section 18-153											

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	Additional standards	HDR	HDMU	HD	CB	RB	CS	O&I	LI	IND	CEM
Civic and institutional											
Assembly	Section 18-126										
Civic club or lodge, private			S	S	P	P	P	P			
Community center					P	P	P	P			
Building footprint up to 5,000 sq. ft.		S	S	S							
Building footprint greater than 5,000 sq. ft.											
With outdoor facilities		S	S	S							
Entertainment and trade			C	S	P	P	P	P			
Religious		C	C	C	P	P	P	P	C		
Chemical dependency treatment facility					P			P			
Community garden	Section 18-134	C	C	C							
Correctional facility	Section 18-137									C	
Daycare, adult or child	Section 18-138		S	S	C	C	C	C	C		
Domestic violence shelter	Section 18-139	C	C	C	P	P	P	P			
Dormitory, fraternity, or sorority house	Section 18-140		S					C			
Government facilities excluding of rights-of-way	Section 18-148		C	C	P	P	P	P	P	P	
Hospital	Section 18-153							C			

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Civic and institutional												
Library	Section 18-155	C	C	C	C	C	C	C	C	C		P
Nursing home												P
Public parks, playgrounds, boat ramps		P	P	P	P	P	P	P	P	P		P
Rehabilitation facility										P		
School	Section 18-167											
College or university										P		P
Primary and secondary		C	C	C	C	C	C	C		P		P
Trade, business, technical, and vocational										C		P
Commercial												
Alternative financial services	Section 18-123									S		C
Animal hospital, veterinary clinic												
No outdoor pens or runs										P		P
With outdoor pens or runs	Section 18-124											
Art gallery										P	P	P
Artisan food and beverage production	Section 18-125									C		C

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**	**CB**	**RB**	**CS**	**O&I**	**LI**	**IND**	**CEM**
Civic and institutional											
Library	Section 18-155		C	S	P	P	P	P			
Nursing home					P			P			
Public parks, playgrounds, boat ramps		P	P	P	P	P	P	P			
Rehabilitation facility					P			P			
School	Section 18-167										
College or university			C	S				P			
Primary and secondary		C	C	C	C	C		C			
Trade, business, technical, and vocational			C	C		P	P	P	P	P	
Commercial											
Alternative financial services	Section 18-123		S	S		C	C				
Animal hospital, veterinary clinic											
No outdoor pens or runs					P	P	P	P	P		
With outdoor pens or runs	Section 18-124				C	C	C	C	C		
Art gallery			P	P	P	P	P	P			
Artisan food and beverage production	Section 18-125		C	C	C	C	C		P		

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Commercial												
Auction house	Section 18-128											P
Banks and financial institutions										P		P
Cemetery												
Commercial parking	Section 18-132	S	S	S	S	S	S	S				C
Commercial recreation, indoor												
Drop-in childcare										P		P
Electronic gaming establishment	Section 18-142											C
General, large: building footprint greater than 2,000 sq. ft.										P		P
General, small: building footprint up to and including 2,000 sq. ft.										P		P
Commercial recreation, outdoor	Section 18-133											
General, large: building footprint greater than 5,000 sq. ft.												
General, small: building footprint up to and including 5,000 sq. ft.										P		P

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**	**CB**	**RB**	**CS**	**O&I**	**LI**	**IND**	**CEM**
Commercial											
Auction house	Section 18-128					C	C		P		
Banks and financial institutions			P	P	P	P	P	P			
Cemetery											P
Commercial parking	Section 18-132				C	C	C	C	C	C	
Commercial recreation, indoor											
Drop-in childcare					P	P	P	P	P		
Electronic gaming establishment	Section 18-142				C	C	C		P		
General, large: building footprint greater than 2,000 sq. ft.			P	P		P	P		P		
General, small: building footprint up to and including 2,000 sq. ft.			P	P	P	P	P		P		
Commercial recreation, outdoor	Section 18-133										
General, large: building footprint greater than 5,000 sq. ft.					P	P			P		
General, small: building footprint up to and including 5,000 sq. ft.					P	P			P		

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Commercial												
Commercial recreation, outdoor												
Golf course												
Golf driving range												
Zoo												
Crematory										P		P
Equipment repair	Section 18-143									P		C
Exterminating services										P		
Farmers' market	Section 18-145									C		P
Food catering services										P		P
Funeral home and mortuary										P		
General business services	Section 18-146									C	C	P
General personal services										P	P	P

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**	**CB**	**RB**	**CS**	**O&I**	**LI**	**IND**	**CEM**
Commercial											
Commercial recreation, outdoor											
Golf course						C					
Golf driving range						C	C				
Zoo						S	S				
Crematory			P	P	P	P	P	P	P	P	P
Equipment repair	Section 18-143		C	C	P	P	P		C	P	
Exterminating services						P	P		P	P	
Farmers' market	Section 18-145				C	C	C				
Food catering services					P	P	P		P		
Funeral home and mortuary			P	P	P	P	P	P			P
General business services	Section 18-146		C	C	C	C	C	C	P	P	
General personal services			P	P	P	P	P	P			

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Commercial												
General retail	Section 18-147											
Large: building footprint 40,001 sq. ft. or larger												P
Medium: building footprint 5,001 sq. ft. - 40,000 sq. ft.										P		P
Small: building footprint up to 5,000 sq. ft.										P	C	P
Heavy equipment sales, rentals, services												
Home maintenance services	Section 18-152									C		
Kennel, commercial	Section 18-154											
Laboratory												
Laundry service										P		P
Lodging	Section 18-157											
Bed and breakfast		C	C	C	C	C	C	C		C		C
Campground									C			

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**	**CB**	**RB**	**CS**	**O&I**	**LI**	**IND**	**CEM**
Commercial											
General retail	Section 18-147										
Large: building footprint 40,001 sq. ft. or larger					C	C	C				
Medium: building footprint 5,001 sq. ft. - 40,000 sq. ft.					P	P	P				
Small: building footprint up to 5,000 sq. ft.			P		P	P	P		P		
Heavy equipment sales, rentals, services						P	P		P	P	
Home maintenance services	Section 18-152		C	C	P	P	P		P		
Kennel, commercial	Section 18-154				C	C	C		P		
Laboratory						P	P	P	P	P	
Laundry service					P	P	P				
Lodging	Section 18-157										
Bed and breakfast		C	C	C							
Campground											

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Commercial												
Lodging	Section 18-157											
Homestay		C	C	C	C	C	C	C		C	C	C
Hotel/motel										P		P
Whole house		C	C	C	C	C	C	C		C		C
Marina	Section 18-157									S		P
Movie theater												P
Nightclub	Section 18-161									C		P
Offices										P	P	P
Recreation facility, neighborhood		P	P	P	P	P	P	P	P	P		P
Recreation facility, private	Section 18-165	S	S	S	S	S	S	S	S	P		P
Restaurant	Section 18-166									P		P
Sexually oriented business	Section 18-169											
Spas and health clubs	Section 18-171									P		P
Studio, performing art, fine art, dance, martial arts										P	P	P

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	Additional standards	HDR	HDMU	HD	CB	RB	CS	O&I	LI	IND	CEM
Commercial											
Lodging	Section 18-157										
Homestay		C	C	C	C	C	C	C			
Hotel/motel					P	P	P	P			
Whole house		C	C	C	C	C	C	C			
Marina	Section 18-158				P	P	P		P	P	
Movie theater						P	P				
Nightclub	Section 18-161				C	P	P		C		
Offices		P	P	P	P	P	P	P	P	P	
Recreation facility, neighborhood											
Recreation facility, private	Section 18-165				P	P	P	P			
Restaurant	Section 18-166		C	C	P	P	P	P	C		
Sexually oriented business	Section 18-169								C	C	
Spas and health clubs	Section 18-171		S	S	P	P	P	P			
Studio, performing art, fine art, dance, martial arts			P	P	P	P	P	P			

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Commercial												
Truck stop	Section 18-172											
Urban farm	Section 18-174	S	S	S	S	S				C		
Vehicle renting	Section 18-175									C		C
Vehicle repair and service	Section 18-176											
Major												
Minor												
Vehicle sales	Section 18-177									C		C
Vehicle towing	Section 18-178											C
Vehicle wash	Section 18-179											C
Water transportation												P
Industrial												
Airport	Section 18-122											
Boat building and repair												
Brewery or distillery	Section 18-129											
Micro										C		C
Small/regional										C		C
Manufacturing												
Building materials or product sales												

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**	**CB**	**RB**	**CS**	**O&I**	**LI**	**IND**	**CEM**
Commercial											
Truck stop	Section 18-172					C	C		C	C	
Urban farm	Section 18-174				C	C	C		C		
Vehicle renting	Section 18-175					C	P		C		
Vehicle repair and service	Section 18-176										
Major						C	C				
Minor					C	C	C		P		
Vehicle sales	Section 18-177					C	C		C		
Vehicle towing	Section 18-178								C	C	
Vehicle wash	Section 18-179					C	C		C		
Water transportation					P	P	P	P	P	P	
Industrial											
Airport	Section 18-122								C	C	
Boat building and repair									P	P	
Brewery or distillery	Section 18-129										
Micro					C	C	C		P	P	
Small/regional						C	C		P	P	
Manufacturing							C		P	P	
Building materials or product sales						P	P		P	P	

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Industrial												
Bus and taxi services										P		P
Contractor storage yard	Section 18-136											
Distribution facilities												
Dry cleaning												
Express and parcel delivery services												P
Freight and intermodal terminals												
Fuel storage facility												
Heavy manufacturing, general												
Heliports/helipads	Section 18-151											
Laundry services, industrial												
Light manufacturing, general	Section 18-156									C		
Manufactured homes sales												
Metal coating, engraving and allied services												
Mills, sawing or planing												
Motion picture production and distribution	Section 18-159									C		

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**	**CB**	**RB**	**CS**	**O&I**	**LI**	**IND**	**CEM**
Industrial											
Bus and taxi services						P	P		P	P	
Contractor storage yard	Section 18-136					C	C		C	P	
Distribution facilities									P	P	
Dry cleaning									P	P	
Express and parcel delivery services									P	P	
Freight and intermodal terminals									P	P	
Fuel storage facility										P	
Heavy manufacturing, general										P	
Heliports/helipads	Section 18-151								C	C	
Laundry services, industrial							P		P	P	
Light manufacturing, general	Section 18-156								P	P	
Manufactured homes sales									P	P	
Metal coating, engraving and allied services									P	P	
Mills, sawing or planing									P	P	
Motion picture production and distribution	Section 18-159						C		P	P	

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Industrial												
Moving company	Section 18-160											
Nurseries and greenhouses	Section 18-162											
Including retail sales												
Not including retail sales												
Outdoor storage	Section 18-163											
Petroleum and natural gas related industries												
Railroad facilities	Section 18-164											
Freight												
Passenger												C
Self-storage facilities	Section 18-168											
Indoor												
Outdoor												
Shipping container storage and sales												
Solar farm	Section 18-170											

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**	**CB**	**RB**	**CS**	**O&I**	**LI**	**IND**	**CEM**
Industrial											
Moving company	Section 18-160					C	P		P	P	
Nurseries and greenhouses	Section 18-162										
Including retail sales					C	P	P		P		
Not including retail sales							P		P	P	
Outdoor storage	Section 18-163						C		C	P	
Petroleum and natural gas related industries										P	
Railroad facilities	Section 18-164										
Freight							C		P	P	
Passenger					C	C	C	C	P	P	
Self-storage facilities	Section 18-168										
Indoor							C		C	C	
Outdoor							C		C	C	
Shipping container storage and sales									P	P	
Solar farm	Section 18-170								C	C	

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Industrial												
Utility and public facility	Section 18-173											
Major										S	S	C
Minor		C	C	C	C	C	C	C	C	C	P	C
Warehouses and distribution centers	Section 18-180									C		
Welding repair												
Wholesale business	Section 18-181											
Wind energy conversion system, commercial	Section 18-182											
Wireless telecommunication facility	Section 18-183	C	C	C	C	C	C	C	C	C	C	S
Residential												
Assisted living residence	Section 18-127	C	C	C	C	C	C	C		S	S	P
Continuum of care community	Section 18-135				C	C	C	C		P		
Dwelling unit	Section 18-141											
Attached: duplex				P	P	P	C	C		P	P	
Attached: multiple							P	P		P		P
Attached: townhouse					C	C	P	P		P		P

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**	**CB**	**RB**	**CS**	**O&I**	**LI**	**IND**	**CEM**
Industrial											
Utility and public facility	Section 18-173										
Major			S	S		C	P	C	P	P	
Minor		C	C	C	P	P	P	C	P	P	
Warehouses and distribution centers	Section 18-180						C		P	P	
Welding repair									P	P	
Wholesale business	Section 18-181						C		P	P	
Wind energy conversion system, commercial	Section 18-182						S		S	S	
Wireless telecommunication facility	Section 18-183	C	C	C	C	C	C	C	C	C	
Residential											
Assisted living residence	Section 18-127		S	S				C			
Continuum of care community	Section 18-135				C			C			
Dwelling unit	Section 18-141										
Attached: duplex		P	P	P							
Attached: multiple		S	C	C							
Attached: townhouse		S	C	C							

Table 18-19.2: Universal use table												
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited												
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**	**UMX**	**RO**	**CBD**
Residential												
Dwelling unit	Section 18-141											
Attached: triplex, quadraplex				C	C	C	P	P		P	P	P
Commercial district mixed use	Section 18-131											
Detached: single		P	P	P	P	P	C	C		P	P	
Manufactured home									P			
Family care home	Section 18-144	C	C	C	C	C	C	C	C	C	C	C
Group home residential	Section 18-149				S	S	S	S		S	S	S
Group home supportive	Section 18-150											
Large							C	C		C	C	C
Medium		C	C	C	C	C	C	C	C	C	C	C
Small		C	C	C	C	C	C	C	C	C	C	C

Table 18-19.2: Universal use table											
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited											
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**	**CB**	**RB**	**CS**	**O&I**	**LI**	**IND**	**CEM**
Residential											
Dwelling unit	Section 18-141										
Attached: triplex, quadraplex		C	C	C							
Commercial district mixed use	Section 18-131				C	C		C			
Detached: single		P	P	P							
Manufactured home											
Family care home	Section 18-144	C	C	C				C			
Group home residential	Section 18-149	S	S	S	S	S	S	S			
Group home supportive	Section 18-150										
Large			S	S	C			C			
Medium		C	C	C	C			C			
Small		C	C	C	C			C			

(Ord. No. O-2022-41, §1, 6-7-2022; Ord. No. O-2023-41, §1, 6-6-2023)

ARTICLE 2. DIVISION 2.

RESIDENTIAL DISTRICTS

Section 18-26: Purpose statements

A. R-15, Moderate-density single-dwelling district

The R-15 district is intended to accommodate existing single-dwelling neighborhoods on moderate sized lots, yielding a gross density of less than three units per acre. Use of the R-15 district should be limited to infill sites in already developed locations.

B. R-10, Medium-density single-dwelling district

The R-10 district is intended to accommodate single-dwelling development at a gross density of about four units per acre. To retain the character of existing neighborhoods and ensure their continued viability, this district permits a variety of residential types at a scale compatible with the established residential surroundings. R-10 frequently serves as a transition between nonresidential or higher-density neighborhoods and lower-density single-dwelling neighborhoods.

C. R-7, Medium-density single-dwelling district

The R-7 district is intended to accommodate compact, walkable neighborhoods proximate and connected to urban services and compatible uses. Relatively small-lot single-dwelling development is permitted in this district at a gross density of about six units per acre. This district permits a variety of residential types at a scale compatible with established surroundings. This district may be used within or as an edge around nonresidential and mixed-use developments.

D. R-5, Medium-density mixed residential district

The R-5 district is intended to accommodate compact, walkable neighborhoods proximate and connected to urban services and compatible uses. This district permits a variety of residential types at a scale compatible with established surroundings. The intent of the district is to allow infill units to be seamlessly integrated within the predominant neighborhood fabric. The district is well suited for infill and mixed-density residential developments. This district should be applied where compatible with the existing urban character, near nodes offering daily services, and either close to transit lines or in conjunction with cohesive mixed-use areas.

E. R-3, Medium-high-density mixed residential district

The R-3 district is intended to accommodate small-lot single dwelling residential uses in or adjoining a mix of residential types, mixed-use, and commercial developments in which compact walkable patterns are desired. This district supports the continued viability of neighborhoods within the 1945 Corporate Limits, where there exists a historic development pattern of small lots with limited setbacks, limited off-street parking, and a vibrant architectural character. This district is created to support reinvestment in mature parts of the city by allowing a variety of compatible housing forms in a dense development pattern consistent with the established character.

F. MD-10, Medium-density multiple-dwelling residential district

The MD-10 district is intended to provide moderate multiple dwelling density living environments near services, as well as transitional residential development between lower-intensity residential neighborhoods and nonresidential activity areas. The district can be used for mid-rise buildings compatible with their surroundings with

direct connectivity to nearby services.

G. MD-17, High-density multiple-dwelling residential district

The MD-17 district is intended to be applied within the urban core of the city and other areas with a full range of amenities and commercial services. MD-17 zoning is intended to provide a mix of densities and housing forms in a compact urban environment through redevelopment, infill on relatively small sites, and within mixed-use areas. Higher development intensity at appropriate locations is encouraged to support transit use, minimize traffic congestion, and provide a range of housing types.

H. MH, Manufactured housing district

The MH district is intended to provide for planned communities of manufactured housing units, either on individual lots or within a mobile home park. A limited range of support services are also permitted in these areas to ensure a convenient living environment.

Section 18-27: Residential use table

The following uses are permitted as principal uses in the residential districts if required applicable conditions and approvals are met.

Uses not listed in this table are prohibited in these districts, pursuant to Section 18-19: Uses. For permitted accessory uses and temporary uses, refer to article 3 of this chapter.

Table 18-27: Use table for residential districts

Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited

Principal use	Additional standards	R-15	R-10	R-7	R-5	R-3	MD-10	MD-17	MH
Civic and institutional									
Assembly	Section 18-126								
Community center									
Building footprint up to 5,000 sq. ft.		S	S	S	S	S	S	S	S
Building footprint greater than 5,000 sq. ft.							S	S	
With outdoor facilities		S	S	S	S	S	S	S	S
Religious		C	C	C	C	C	C	C	C
Community garden	Section 18-134	C	C	C	C	C	C	C	C
Daycare, adult or child	Section 18-138	C	C	C	C	C	C	C	
Domestic violence shelter	Section 18-139	C	C	C	C	C	C	C	
Dormitory, fraternity, or sorority house	Section 18-140						S	S	
Government facility excluding of rights-of-way	Section 18-148	C	C	C	C	C	C	C	C
Library	Section 18-155	C	C	C	C	C	C	C	C
Public parks, playgrounds, boat ramps		P	P	P	P	P	P	P	P
School	Section 18-167								
Primary and secondary		C	C	C	C	C	C	C	

Table 18-27: Use table for residential districts									
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited									
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**
Commercial									
Commercial parking	Section 18-132	S	S	S	S	S	S	S	
Lodging	Section 18-157								
Bed and breakfast		C	C	C	C	C	C	C	
Campground									C
Homestay		C	C	C	C	C	C	C	
Whole-house		C	C	C	C	C	C	C	
Recreation facility, neighborhood		P	P	P	P	P	P	P	P
Recreation facility, private	Section 18-165	S	S	S	S	S	S	S	S
Urban farm	Section 18-174	S	S	S	S	S			
Industrial									
Utility and public facility	Section 18-173								
Minor		C	C	C	C	C	C	C	C
Wireless telecommunication facility	Section 18-183	C	C	C	C	C	C	C	C

Table 18-27: Use table for residential districts									
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited									
Principal use	**Additional standards**	**R-15**	**R-10**	**R-7**	**R-5**	**R-3**	**MD-10**	**MD-17**	**MH**
Residential									
Assisted living residence	Section 18-127	C	C	C	C	C	C	C	
Continuum of care community	Section 18-135				C	C	C	C	
Dwelling unit	Section 18-141								
Attached: duplex				P	P	P	C	C	
Attached: multiple							P	P	
Attached: townhouse					C	C	P	P	
Attached: triplex, quadraplex				C	C	C	P	P	
Detached: single		P	P	P	P	P	C	C	
Manufactured home									P
Family care home	Section 18-144	C	C	C	C	C	C	C	C
Group home residential	Section 18-149				S	S	S	S	
Group home supportive	Section 18-150								
Large							C	C	
Medium		C	C	C	C	C	C	C	C
Small		C	C	C	C	C	C	C	C

(Ord. No. O-2022-41, §2, 6-7-2022)

Section 18-28: Dimensional standards

All lots and buildings, including new lots, shall meet the requirements of Table 18-28.1: Single-dwelling dimensional standards, Table 18-28.2: Multiple-dwelling dimensional standards, or Table 18-28.3: Manufactured housing dimensional standards, as applicable.

Table 18-28.1: Single-dwelling dimensional standards

	R-15	R-10	R-7	R-5	R-3
Lot requirements					
Minimum lot area (square feet)					
Detached	15,000	10,000	7,000	5,000	None
Duplex (total lot area)			9,800	7,000	4,000
Triplex, quadraplex (per unit)			3,500	3,500	2,000
Townhouse (per unit)				3,500	2,000
Minimum lot width (feet)	80	70	50	50	33
Minimum open space (percent of parent lot area for development of 5 or more lots)	10	10	10	10	10
Minimum setbacks(feet)					
Front	20	15	10	10	10
Side street	15	15	10	10	5
Side interior	10	10	8½	7	5
Rear	25	25	20	15	15
Building size					
Maximum height (feet)	35	35	35	35	35
Maximum building footprint (percent of total lot area)	50	50	50	None	None

Figure 18-28.1: Single-dwelling residential dimensions

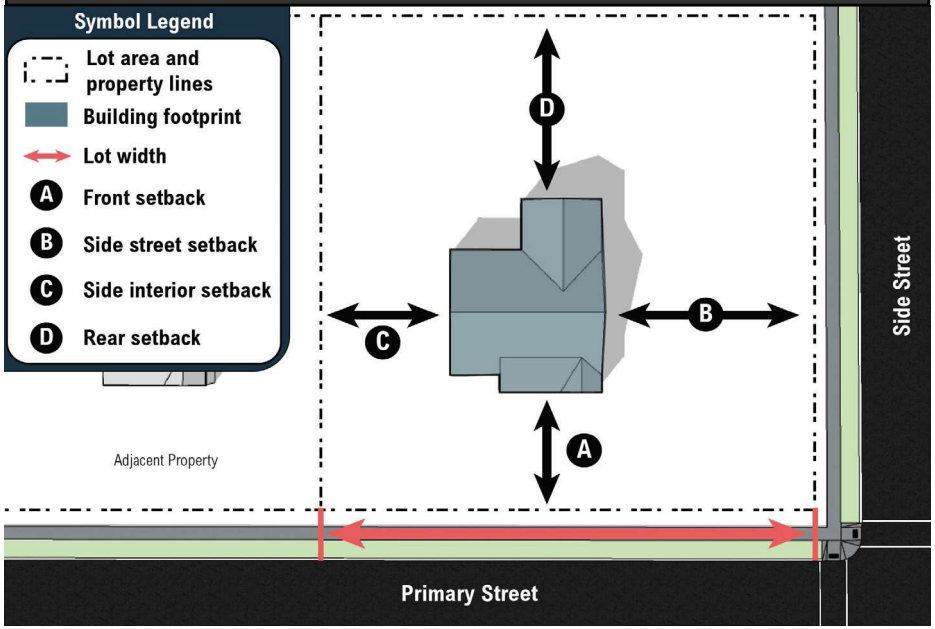
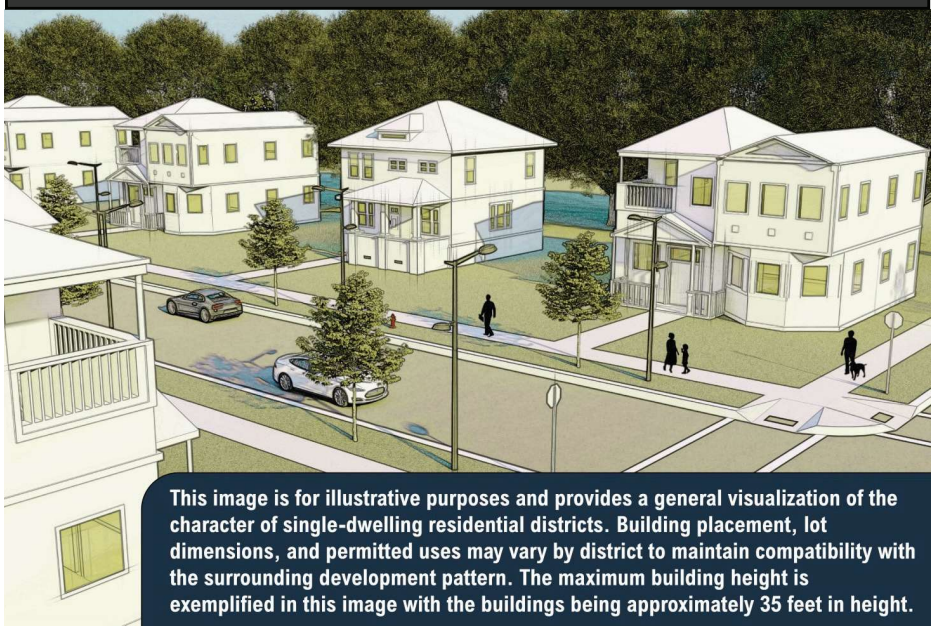


Figure 18-28.2: Single-dwelling residential example



This image is for illustrative purposes and provides a general visualization of the character of single-dwelling residential districts. Building placement, lot dimensions, and permitted uses may vary by district to maintain compatibility with the surrounding development pattern. The maximum building height is exemplified in this image with the buildings being approximately 35 feet in height.

A. Single-dwelling residential

The following dimensional standards apply to new development, new lots, and conversion of existing buildings in single-dwelling residential districts. Applicable district-specific standards shall also apply (see figures 18-28.1: Single-dwelling residential dimensional and 18-28.2 Single-dwelling residential dimensions).

1. In the R-7, R-5, and R-3 districts, where duplex, triplex, quadraplex, or townhouse uses are permitted, the minimum lot width may be measured from the parent lot lines (see Figure 18-28.3: Minimum lot width for attached units). Setbacks for such attached units shall be applied to the overall building and not to each individual unit (see Figure 18-28.4: Setbacks for attached units).
2. In the R-5 and R-3 districts, the front and rear setbacks shall be those established in Table 18-28.1: Single-dwelling dimensional standards, or they may be reduced to within five feet of the average established setback on the same block face.
3. The maximum allowable height for piling-supported buildings located in the coastal high hazard areas, V-zones, and ocean hazard areas, as defined by the North Carolina Coastal Resources Commission, shall be 44 feet.
4. Alternative lot layouts may be approved subject to the provisions of Article 5, Division 8, Site Development Requirements.
5. For properties that are located within the city's 1945 corporate limits, the minimum side yard setbacks shall be equal to ten (10) percent of the average width of the lot, or the otherwise noted minimum interior side yard required, whichever is less.

Figure 18-28.3: Minimum lot width for attached units

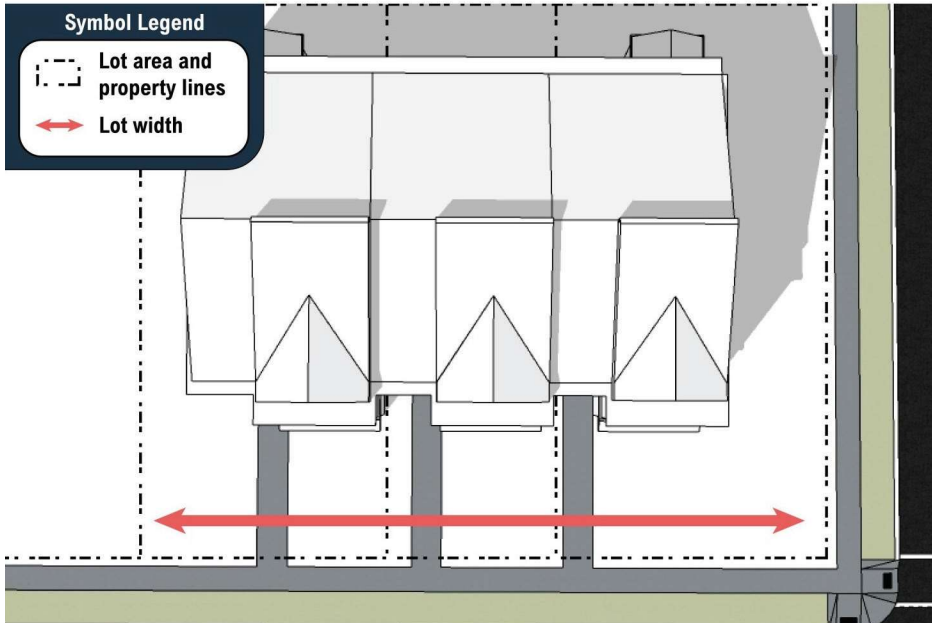
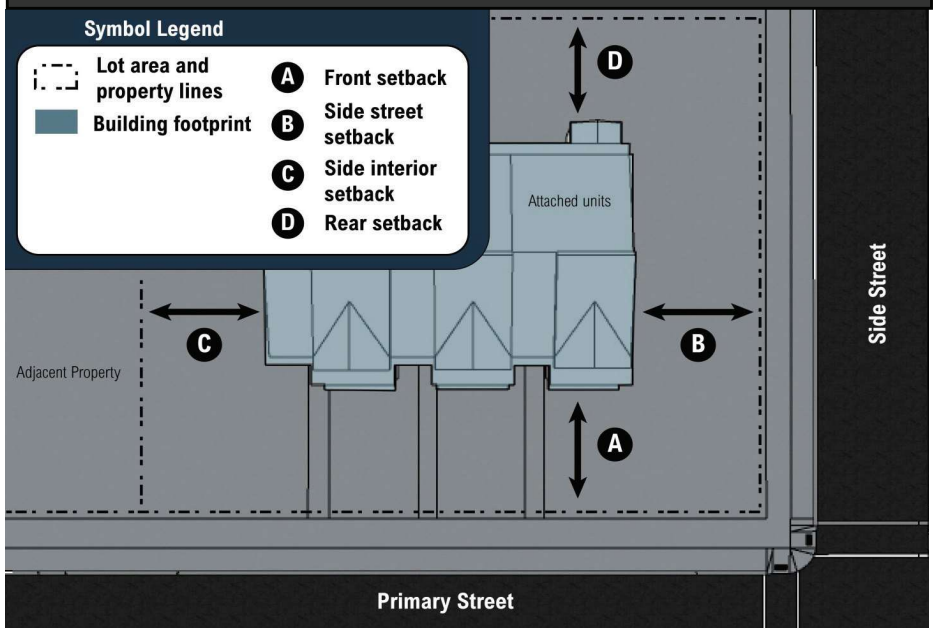


Figure 18-28.4: Setbacks for attached units



B. Multiple-dwelling residential

The following dimensional standards apply in the multiple-dwelling residential districts (see figures 18-28.5 Multiple-dwelling residential dimensions and 18-28.6 Multiple-dwelling residential example).

Table 18-28.2: Multiple-dwelling dimensional standards

	MD-10	MD-17
Lot requirements		
Maximum density (units/acre)	10	17
Minimum open space (percent of total lot area)	20	20
Minimum setbacks (feet)		
Front	10	10
Side street	10	10
Side interior	5	5
Rear	15	15
Building size		
Maximum height (feet)	96	96
Maximum building footprint (percent of total lot area)	50	70

1. Density may be increased to 36 units per acre if at least 10 percent of the total number of residential units are designated as workforce housing, as defined in this chapter, for a period of at least 15 years.
2. For lots subject to frontage standards per article 5, division 6 of this chapter, the frontage standards shall apply.
3. For projects with multiple buildings, workforce housing units must be dispersed throughout the development and not concentrated in one building.

Figure 18-28.5: Multiple-dwelling residential dimensions

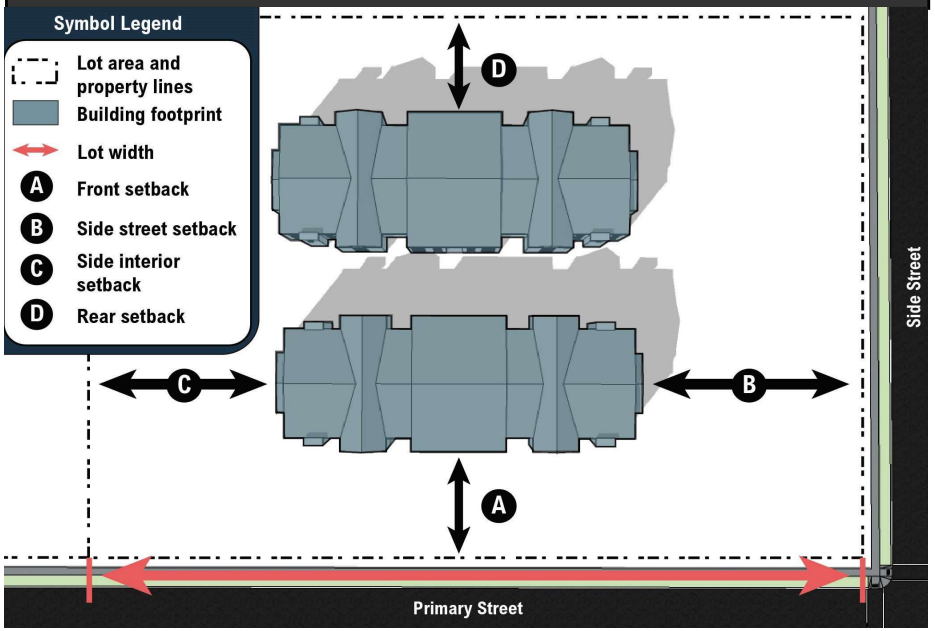
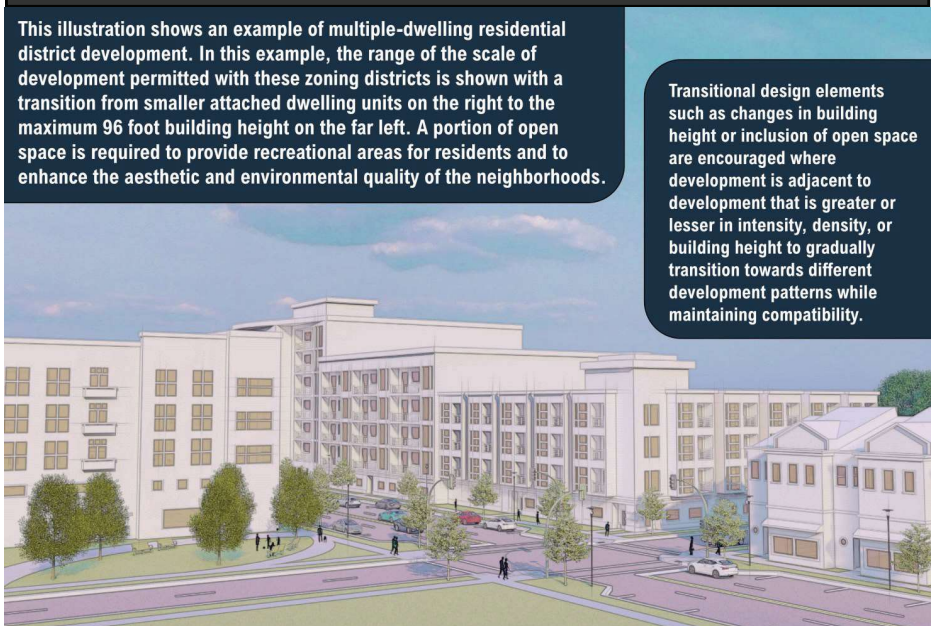


Figure 18-28.6: Multiple-dwelling residential example



C. Manufactured housing district

Development and new lots in the MH district shall conform to the following standards. Relevant district-specific standards shall also apply (see figures 18-28.7 Manufactured housing district dimensions and 18-28.8 Manufactured housing district example).

Table 18-28.3: Manufactured housing dimensional standards

	Individual lots	Mobile home park
Lot requirements		
Minimum lot area (square feet)		
Manufactured homes	4,000	1 acre
Nonresidential use	10,000	10,000
Minimum lot width (feet)	33	100
Maximum density (units/acre)	11	11
Minimum open space (percent of total lot area)	10	15
Building placement		
Minimum setbacks (feet)		
Front	10	10
Side street	10	10
Side interior	10	10
Rear	10	10
Minimum spacing (feet)		
Between mobile homes	20	20
Between mobile home and another structure or building	15	15
Maximum height		
Maximum height (feet)	35	35
Maximum building footprint (percent of total lot area)	50	

Figure 18-28.7: Manufactured housing district dimensions

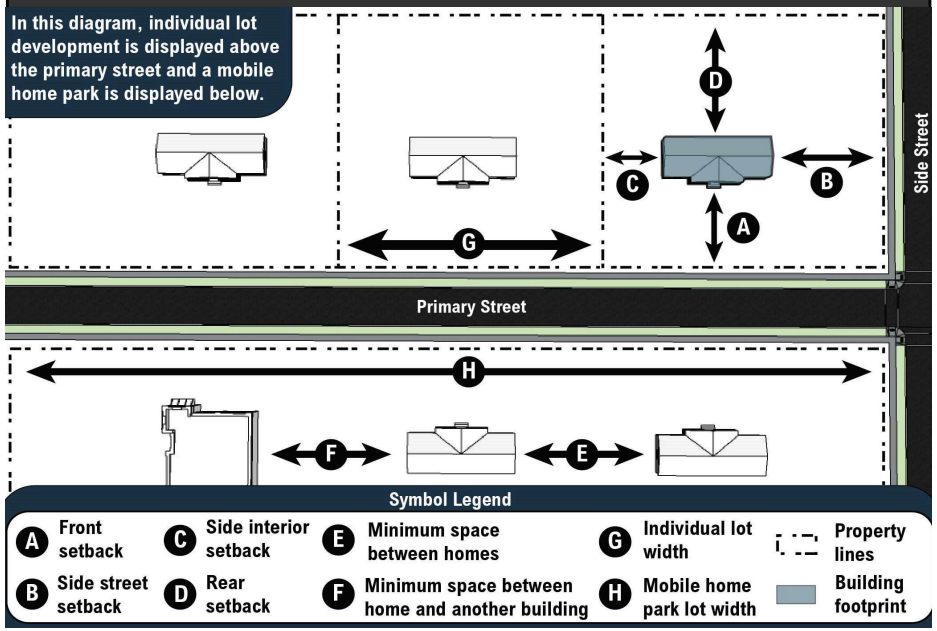
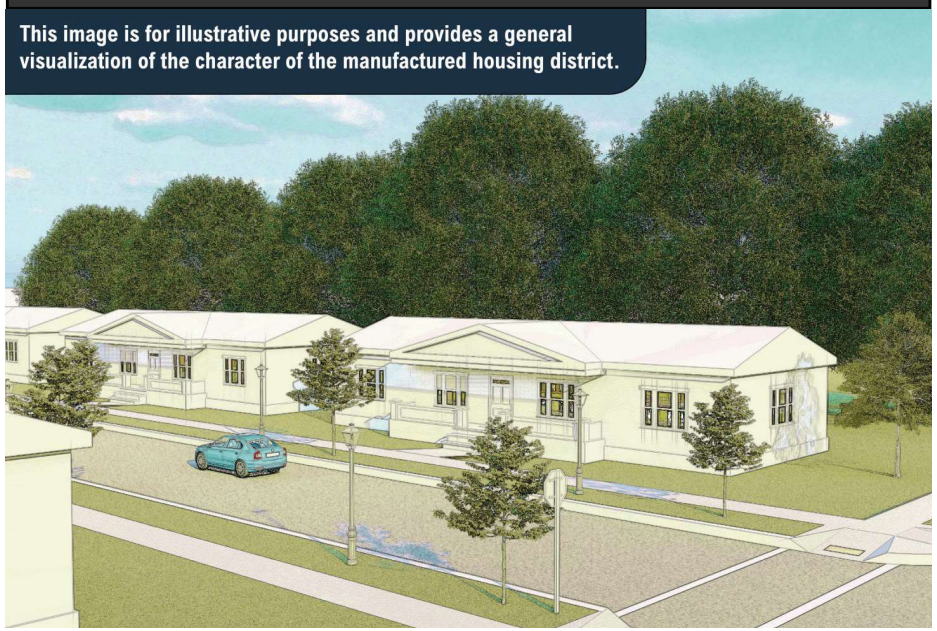


Figure 18-28.8: Manufactured housing district example



(Ord. No. O-2022-41, §§3, 4, 6-7-2022)

Section 18-29: District-specific standards

A. Multiple-dwelling districts

All multiple-dwelling developments shall comply with the following.

Along certain streets, applicable frontage standards shall also be applied.

1. Site design standards

    a. Pedestrian paths shall be provided within the development between dwelling units and destinations, including, but not limited to, parking, adjoining streets, mailboxes, waste disposal, adjoining public sidewalks or greenways, and on-site amenities such as recreation areas.

    b. Berms shall not be placed between a building and a street.

    c. Parking, loading, and service areas shall not be permitted within 35 feet of the corner of a street intersection. This standard may be waived by the technical review committee if the site is an adaptive reuse of a building at least 50 years old (see Figure 18-29.1 MD parking, loading, and service areas).

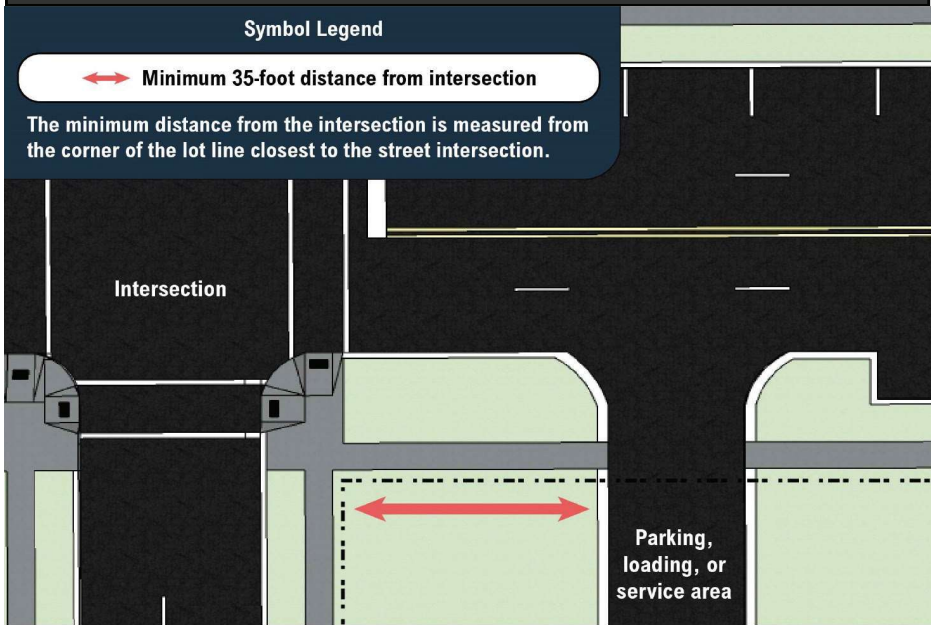
2. Building design standards

    a. All buildings shall provide a clearly identifiable entry from the public sidewalk at the front (primary street) elevation.

    b. All buildings shall be oriented towards a public or private street or a designated public space (e.g. common courtyard, plaza, green, etc.) in terms of architectural interest and building access.

    c. Form-giving elements such as, but not limited to galleries, balconies, projected entrances, and overhangs are required on the street-facing facade.

Figure 18-29.1: MD parking, loading, and service areas



    d. Facades shall be designed to be viewed from multiple directions with consistent materials and treatments that wrap around all facades. There shall be a unifying architectural theme for an entire development, utilizing a common vocabulary of architectural forms, elements, materials, and colors around the entire structure.

    e. Building wall materials shall consist of concrete masonry units with stucco (e.g., reinforced concrete parged with stucco), fiber cement siding, wood, or natural brick or stone.

    f. Shed, flat, and mono-pitch roofs shall be concealed with parapets when a roofline is visible from a street frontage.

    g. Garages and accessory structures, including dumpster enclosures, shall not be located between a building and a street, and shall be subordinate in height and building footprint to the principal building(s) on the site, and consist of the same roof forms, materials, and colors.

B. Manufactured housing district

1. Site design standards

   a. All manufactured homes on individual lots shall have access to a public street.

   b. Within a manufactured housing park, the following shall apply:

      i. Setbacks shall be measured from the perimeter of the parent lot and the parent lot shall not be subdivided.

      ii. At least 3,000 square feet of area per manufactured home shall be provided.

2. Design standards

   Manufactured homes shall be installed on a permanent foundation or skirting such that the crawl space, wheels and other transporting devices beneath the unit are fully enclosed.

(Ord. No. O-2022-41, §5, 6-7-2022; Ord. No. O-2023-41, §7, 6-6-2023)

Sections 18-30 - 18-40 Reserved.

Figure 18-29.2: Architectural elements example

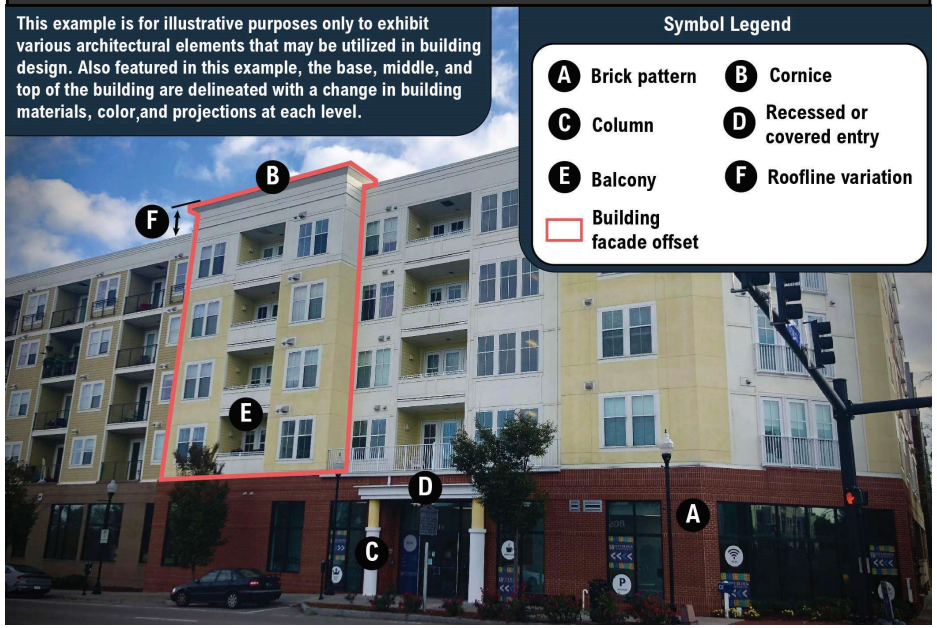
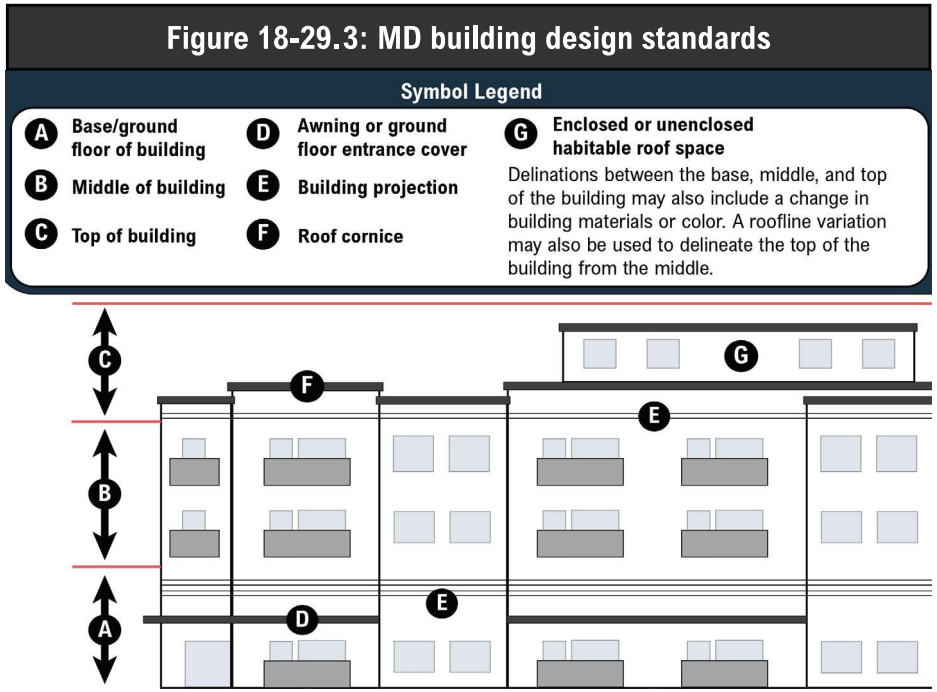


Figure 18-29.3: MD building design standards



ARTICLE 2. DIVISION 3.

MIXED-USE DISTRICTS

Section 18-41: Purpose statements

A. UMX, Urban mixed-use district

The urban mixed-use district is intended to assure an appropriate development pattern is maintained within the 1945 Corporate Limits through five main objectives:

1. Enhance and preserve existing urban development patterns by encouraging compatible infill and redevelopment;
2. Effect quality design and a variety of built forms of lasting value that result in a pedestrian scale;
3. Provide a mix of housing options;
4. Promote and enhance transit options, particularly those that are pedestrian-oriented, while reducing demand for automobile trips; and
5. Encourage a mix of uses to foster a sense of community.

District regulations include design elements intended to enhance the urban form, increase neighborhood safety, add flexibility for small, urban lots, and complement the historic built environment. The historic urban development pattern frequently includes a fine-grain mix of uses on multiple lots within close proximity to one another. The mix of uses is achieved through many smaller, independent lots working together in a greater context. The UMX district is also intended to help implement goals of placemaking, bicycle, and pedestrian connectivity, and a strong urban form. This district is not intended to be applied to separate use historic districts. UMX is not intended to be applied outside of the 1945 Corporate Limits.

B. RO, Residential office district

The RO district is intended to allow for the conversion of existing single-dwelling homes to offices and other compatible low-intensity uses along portions of Oleander Drive. This district facilitates redevelopment options that will retain and enhance area character, minimize impacts on adjacent residential uses, encourage the adaptive reuse of existing residential buildings, encourage new development to be of a residential scale and proportion, ensure compatibility of building and site design in the district, protect trees, require interconnectivity, including bicycle and pedestrian connections, and control access to minimize the impacts of redevelopment on Oleander Drive. This zoning district is only intended for lots fronting Oleander Drive generally between Pine Grove Drive and 51st Street.

C. CBD, Central business district

The CBD is intended to create and maintain a high-density commercial, office, service, and residential area meeting city, county, and regional needs. It encourages the full utilization of public services and contributes to the economic base of the city. The CBD is intended to be a walkable, living, working, learning, and mixed-use community. The intent of the CBD standards is to achieve the following:

1. Recognize, preserve, and respect historic resources;
2. Promote the economic viability of the district;
3. Preserve the cohesive character of the downtown area with compatible, sympathetic development; and
4. Provide an enhanced pedestrian experience.

Section 18-42: Mixed-use use table

The following uses are permitted as principal uses in the mixed-use districts if required applicable conditions and approvals are met.

Uses not listed in this table are prohibited in these districts, pursuant to Section 18-19: Uses. For permitted accessory uses and temporary uses, refer to article 3 of this chapter.

Table 18-42: Use table for mixed-use districts

Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited

Principal use	Additional standards	UMX	RO	CBD
Civic and institutional				
Assembly	Section 18-126			
Civic club or lodge, private		P		P
Community center				
Building footprint up to 5,000 sq. ft.		C		P
Building footprint greater than 5,000 sq. ft.		C		P
With outdoor facilities		C		P
Entertainment and trade		C		P
Religious		C		P
Chemical dependency treatment facility		P		
Community garden	Section 18-134	C	C	C
Daycare, adult or child	Section 18-138	C		C
Domestic violence shelter	Section 18-139	P	P	P
Dormitory, fraternity, or sorority house	Section 18-140	S		C
Government facility excluding of rights-of-way		P		P
Library	Section 18-155	C		P

Table 18-42: Use table for mixed-use districts				
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited				
Principal use	**Additional standards**	**UMX**	**RO**	**CBD**
Civic and institutional				
Nursing home				P
Public parks, playgrounds, boat ramps		P		P
Rehabilitation facility		P		
School	Section 18-167			
College or university		P		P
Primary and secondary		P		P
Trade, business, technical, and vocational		C		P
Commercial				
Alternative financial services	Section 18-123	S		C
Animal hospital, veterinary clinic				
No outdoor pens or runs		P		P
Art gallery		P	P	P
Artisan food and beverage production	Section 18-125	C		C
Auction house				P
Banks and financial institutions		P		P

Table 18-42: Use table for mixed-use districts				
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited				
Principal use	**Additional standards**	**UMX**	**RO**	**CBD**
Commercial				
Commercial parking	Section 18-132			C
Commercial recreation, indoor				
Drop-in childcare		P		P
Electronic gaming establishment	Section 18-142			C
General, large: building footprint greater than 2,000 sq. ft.		P		P
General, small: building footprint up to and including 2,000 sq. ft.		P		P
Commercial recreation, outdoor				
General, small: building footprint up to and including 5,000 sq. ft.		P		P
Crematory		P		P
Equipment repair	Section 18-143	P		C
Exterminating services		P		
Farmers' market		C		P
Food catering services		P		P
Funeral home and mortuary		P		P

Table 18-42: Use table for mixed-use districts				
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited				
Principal use	**Additional standards**	**UMX**	**RO**	**CBD**
Commercial				
General business services	Section 18-146	C	C	P
General personal services		P	P	P
General retail	Section 18-147			
Large: building footprint 40,001 sq. ft. or larger				P
Medium: building footprint 5,001 sq. ft. - 40,000 sq. ft.		P		P
Small: building footprint up to and including 5,000 sq. ft.		P	C	P
Home maintenance services	Section 18-152	C		
Laboratory				P
Laundry service		P		P
Lodging	Section 18-157			
Bed and breakfast		C		C
Homestay		C	C	C
Hotel/motel		P		P
Whole house		C		C

Table 18-42: Use table for mixed-use districts				
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited				
Principal use	**Additional standards**	**UMX**	**RO**	**CBD**
Commercial				
Marina	Section 18-158	S		P
Movie theater				P
Nightclub	Section 18-161	C		P
Offices		P	P	P
Recreation facility, neighborhood		P		P
Recreation facility, private		P		P
Restaurant		P		P
Spas and health clubs		P		P
Studio, performing art, fine art, dance, martial arts		P	P	P
Urban farm	Section 18-174	C		
Vehicle renting	Section 18-175	C		C
Vehicle sales	Section 18-177	C		C
Vehicle towing	Section 18-178			C
Vehicle wash	Section 18-179			C
Water transportation				P

Table 18-42: Use table for mixed-use districts				
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited				
Principal use	**Additional standards**	**UMX**	**RO**	**CBD**
Industrial				
Brewery or distillery	Section 18-129			
Micro		C		C
Small/regional		C		C
Bus and taxi service		P		P
Express and parcel delivery services				P
Light manufacturing, general	Section 18-156	C		
Motion picture production and distribution	Section 18-159	C		
Railroad facilities, passenger	Section 18-164			C
Utility and public facility	Section 18-173			
Major		S	S	C
Minor		C	P	C
Warehouse and distribution centers	Section 18-180	C		
Wireless telecommunication facility	Section 18-183	C	C	S

Table 18-42: Use table for mixed-use districts				
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited				
Principal use	**Additional standards**	**UMX**	**RO**	**CBD**
Residential				
Assisted living residence	Section 18-127	S	S	P
Continuum of care community	Section 18-135	P		
Dwelling unit	Section 18-141			
Attached: duplex		P	P	
Attached: multiple		P		P
Attached: townhouse		P		P
Attached: triplex, quadplex		P	P	P
Detached: single		P	P	
Family care home	Section 18-144	C	C	C
Group home residential	Section 18-149	S	S	S
Group home supportive	Section 18-150			
Large		C	C	C
Medium		C	C	C
Small		C	C	C

(Ord. No. O-2022-41, §6, 6-7-2022; Ord. No. O-2022-88, §1(Att. A), 11-1-2022; Ord. No. O-2023-41, §1, 6-6-2023)

Section 18-43: Dimensional standards

A. Urban mixed-use district

Development and new lots in the UMX district shall conform to the standards prescribed in Table 18-43.1. Relevant district-specific standards shall also apply (see figures 18-43.1 UMX district dimensions and 18-43.2 UMX district example).

Table 18-43.1: Urban mixed-use district dimensional standards

	Single dwelling	Single-use building	Vertically-integrated mixed-use building
Lot requirements			
Maximum density (units/acre)	15	25	None
Minimum lot width (feet)	33	33	33
Minimum lot area (feet)	4,000	10,000	n/a
Building placement			
Setbacks (feet)			
Front (maximum)	10	10	10
Side	None required		
Rear	None required		
Minimum setbacks (feet) when abutting single-dwelling residential			
Side	5	5	5
Rear	5	5	5
Building size			
Maximum height (feet)	45	45	45
Maximum building footprint	None		

Figure 18-43.1: UMX districts dimensions

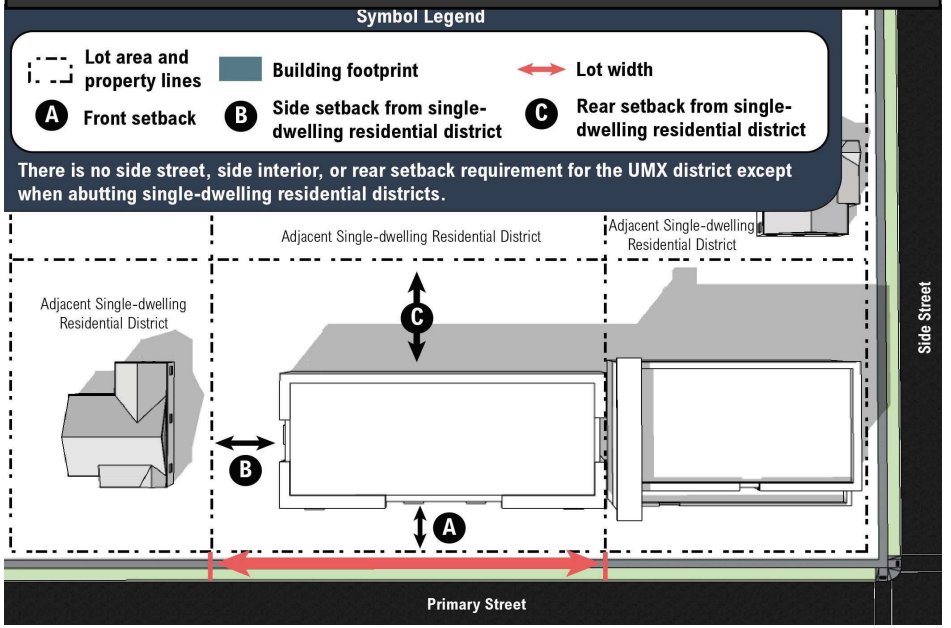


Figure 18-43.2: UMX district example



1. If a site is developed with at least one vertically-integrated mixed-use building, the vertically integrated mixed-use building standards shall be applied.
2. If a site is developed with only single-use building(s), including only commercial or only multiple dwelling uses in a single building, the single-use building standards shall be applied.
3. If a site is developed with only single-dwelling uses, the single dwelling standards shall be applied.
4. The required setbacks adjacent to single-dwelling residential zoning are not applicable when the UMX district is separated from the single-dwelling district by a street or alley.
5. Strict adherence to the 10-foot maximum setback may be waived by the technical review committee where an existing easement or natural feature exists, where conflicts with sight distance triangles exist, or where the predominant setback of the block face exceeds 10 feet. If the predominant setback of the block face exceeds 10 feet, the proposed building shall align to within five feet of the predominant setback.
6. Sites with one or more of the following characteristics shall designate all corresponding street frontages as a "primary frontage:"
    a. Any identified street type shown in Figure 18-43.3: Primary frontage streets—UMX;
    b. A block face along which the majority of buildings are oriented toward that block (see Figure 18-43.4: Primary frontage street example —UMX).

Figure 18-43.3: Primary frontage streets - UMX

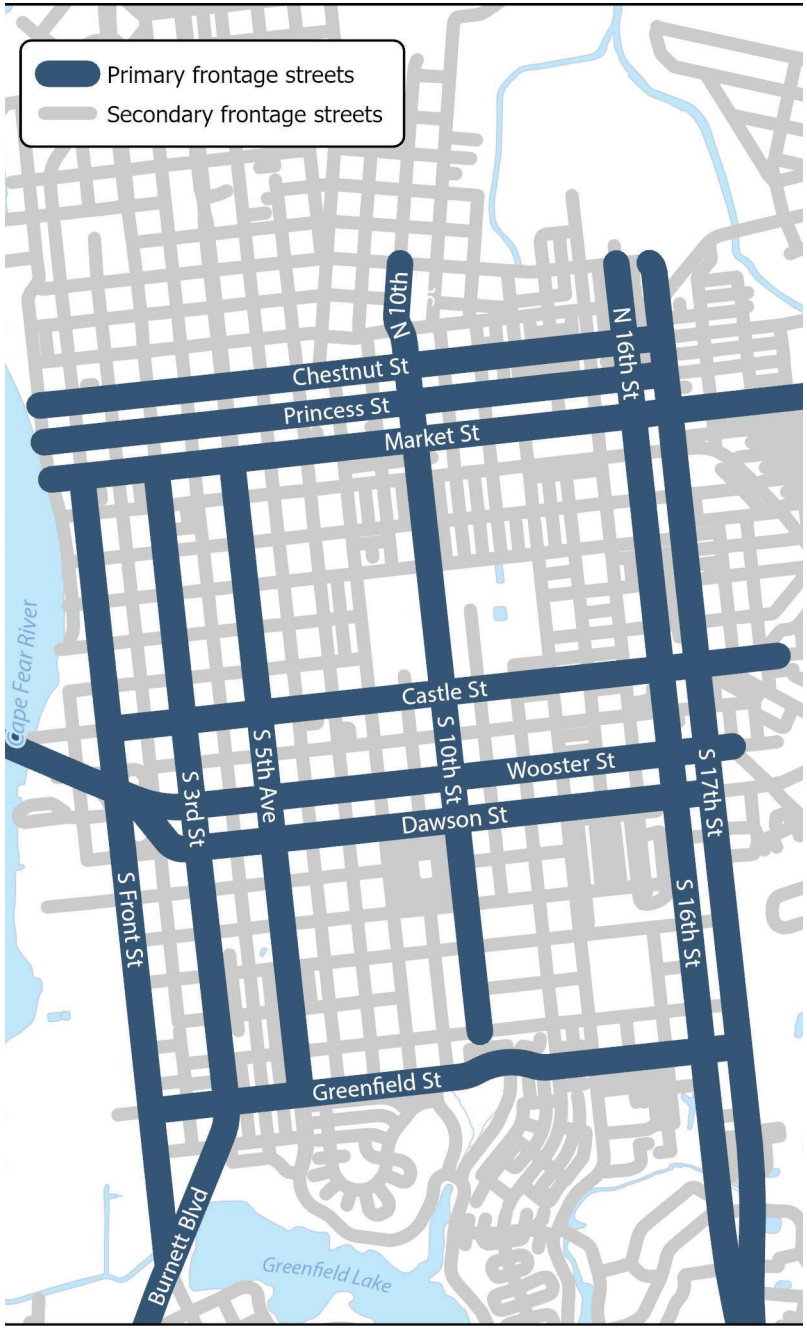
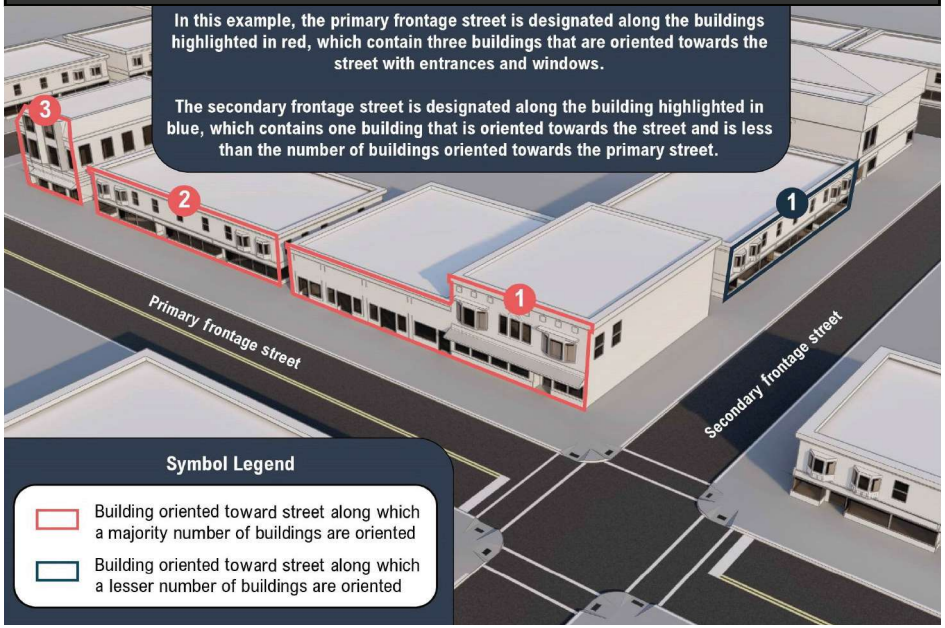


Figure 18-43.4: Primary frontage street example - UMX



B. Residential office district

Development and new lots in the RO district shall conform to the standards prescribed in Table 18-43.3. Relevant district-specific standards shall also apply (see figures 18-43.5: RO district dimensions and 18-43.6: RO district example)

Table 18-43.3: Residential office district dimensional standards

	RO
Lot requirements	
Maximum residential density (units/acre)	6
Minimum lot area (square feet)	15,000
Minimum lot width (feet)	80
Maximum lot width (feet)	160
Setbacks (feet)	
Front (maximum)	Within 5 feet of predominant setback on blockface
Side street (minimum)	15
Side interior (minimum)	10
Rear (minimum)	25
Setback for parking areas from all property lines (minimum, feet)	5
Building size	
Maximum height (feet)	35 feet and two stories

Figure 18-43.5: RO district dimensions

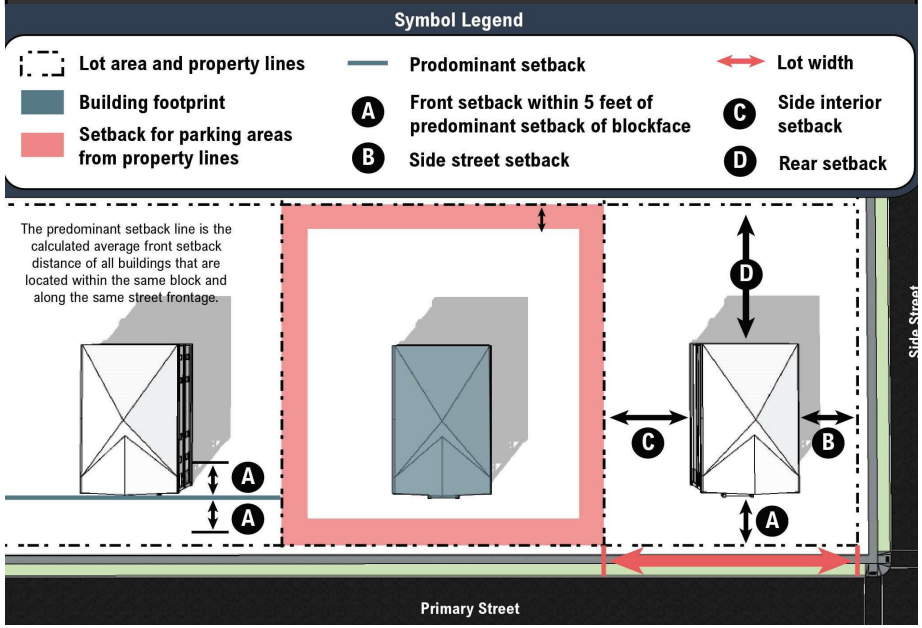
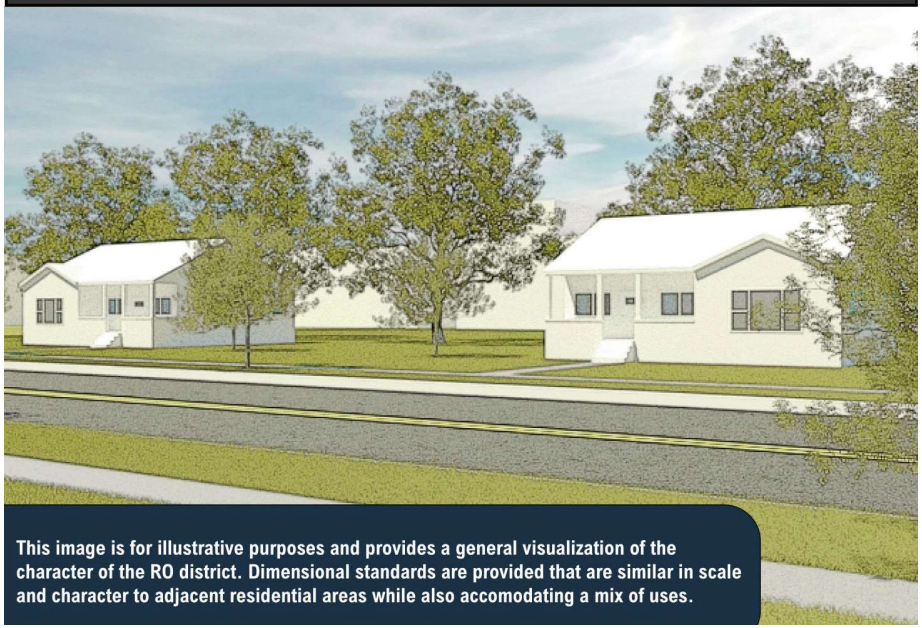


Figure 18-43.6: RO district example



C. Central business district

Development and new lots in the central business district shall conform to the standards prescribed in Table 18-43.4. In some cases, standards specific to the special character areas and lots with three or more street frontages shall also apply (see figures 18-43.7 CBD district dimensions and 18-43.8 CBD district example).

1. Maximum setbacks may be adjusted if a pedestrian-oriented area is provided according to Section 18-44: District-specific standards, subsection C.

2. There is no minimum or maximum rear setback when not adjacent to single-dwelling residential zoning or an alley.

Table 18-43.4: Central business district dimensional standards	
	CBD
Lot requirements	
Maximum residential density (units/acre)	None
Minimum lot area (square feet)	None
Minimum lot width (feet)	20
Maximum lot width (feet)	0
Setbacks (feet)	
Front (maximum)	5
Side street (maximum)	5
Side interior, residential adjacent (minimum)	5
Rear (minimum), single-dwelling zoning adjacent	5
Rear, alley adjacent (minimum)	5
Building size	
By-right height (feet)	See Figure 18-43.9: CBD height map
Minimum ground floor height (feet)	13

(Ord. No. O-2022-88, §1(Att. A), 11-1-2022)

Figure 18-43.7: CBD district dimensions

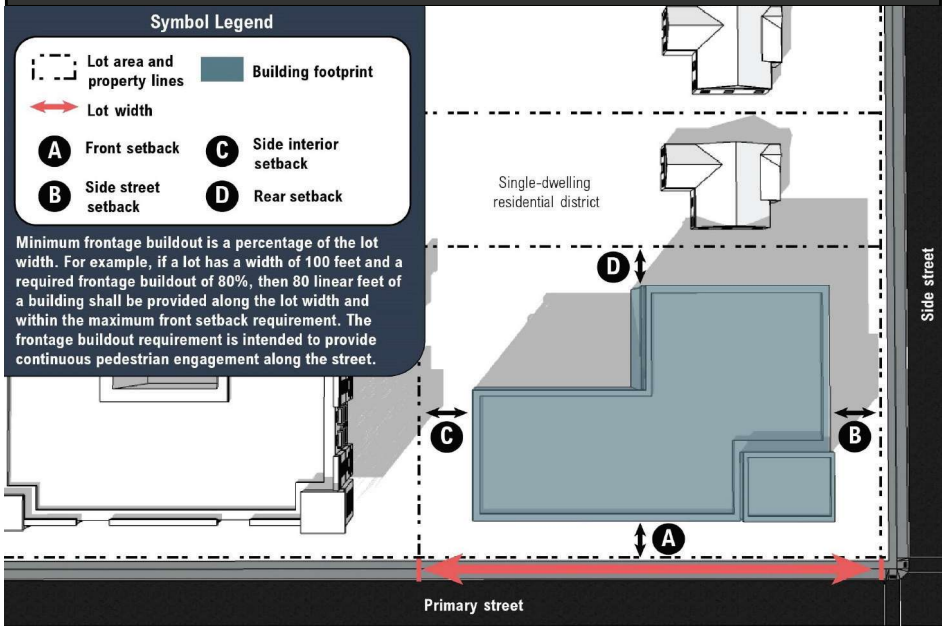
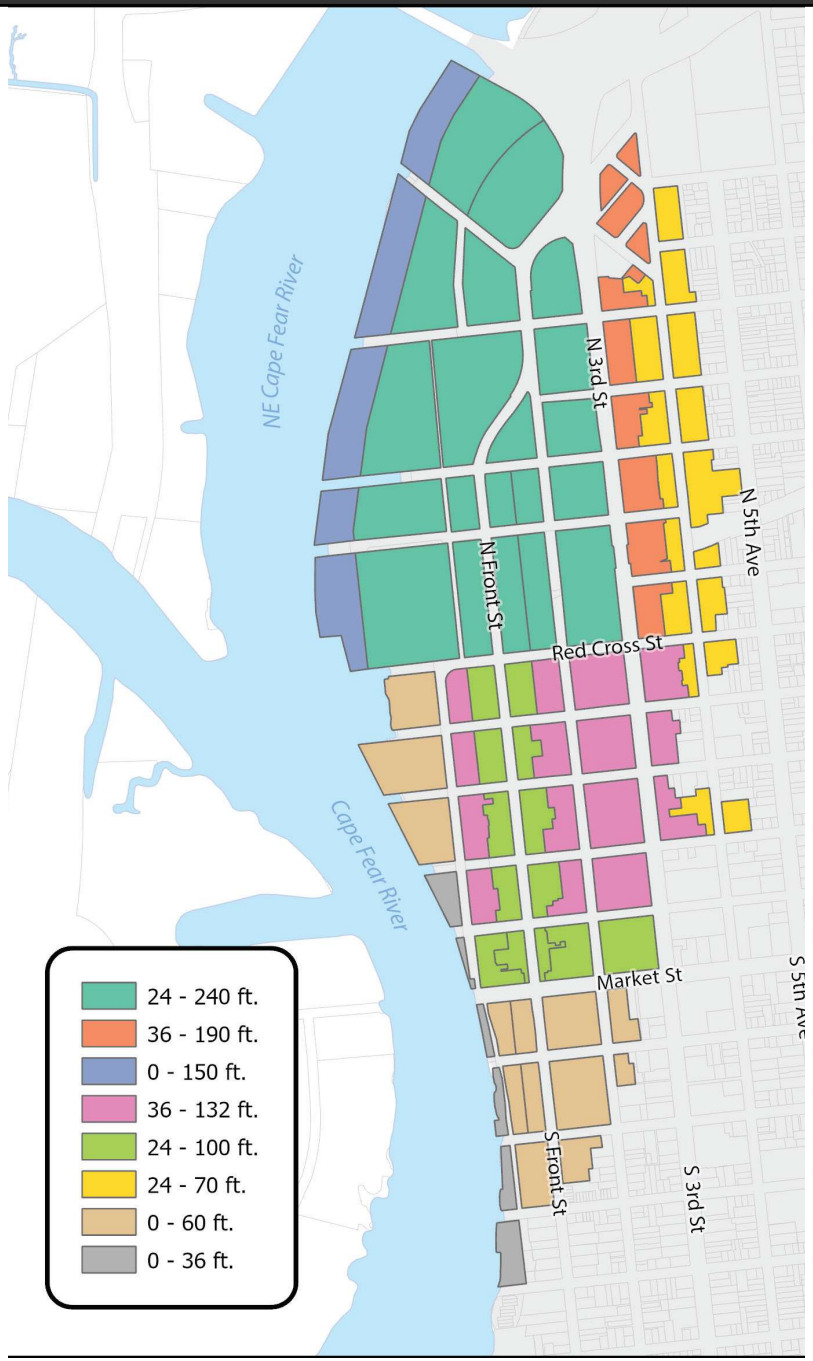


Figure 18-43.8: CBD district example



Figure 18-43.9: CBD height map



Section 18-44: District-specific standards

A. UMX district

The following standards apply to all UMX development. Along certain streets, applicable frontage standards shall also be applied.

1. Building design

   a. All new construction, excluding detached single-dwelling and duplex dwelling units, shall comply with the following design standards, where applicable.

   b. Entrances

      i. Primary building entrances shall be clearly defined and distinctive by using at least two of the following architectural elements (See Figure 18-44.2: Primary building entrance architectural elements):

         1. A recession of the entrance of at least five feet;

         2. Entrance roofs such as awnings, overhangs, canopies, or eaves;

         3. A chamfered corner;

         4. Sidelight, transom, or adjacent windows;

         5. Additional moldings with expression lines; or

         6. A bay of unique width.

      ii. Primary building entrances shall be oriented toward public sidewalks along primary street frontages.

iii. For buildings on corner lots, the primary entrance(s) shall be located within 10 feet of the corner of intersecting streets (see Figure 18-44.3: Primary entrances distance).

c. Facade

Building facades along rights-of-way shall incorporate periodic transitions across the facade (see Figure 18-44.4 Building facade transitions).

i. Along rights-of-way, building facades exceeding 30 feet in width shall be divided into distinct areas utilizing methods including, but not limited to, facade offsets, pilasters, change in materials, or fenestration.

ii. Transition elements shall be no farther apart than two-thirds of the height of the facade.

d. Fenestration

i. A street-level facade that faces a public street, riverwalk, or sidewalk shall have fenestration for a minimum 50 percent of the facade area (see Figure 18-44.5: Building fenestration).

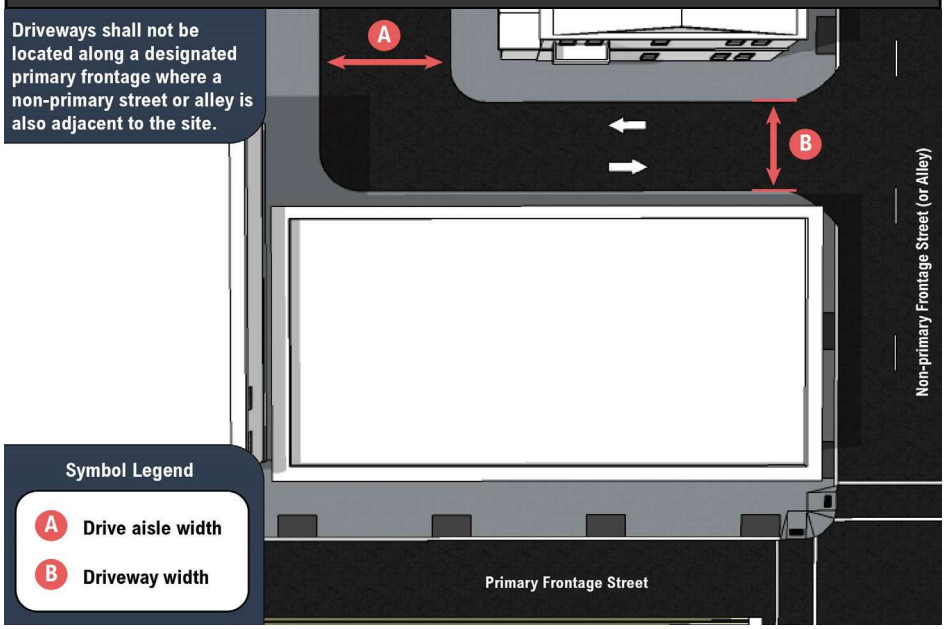
ii. Windows may extend from a sill or base. Any sill or base shall not exceed four feet in height from the adjacent grade.

iii. Glass shall be transparent with a maximum 15 percent reflectivity. Window tinting and interior affixed window shades that create a permanently opaque or translucent condition are prohibited. Spandrel or colored glass may be used in transom areas above door headers only.

iv. Exterior burglar bars, fixed riot shutters, or similar security devices shall not be visible from the public right-of-way.

e. Exterior building materials

Figure 18-44.1: UMX parking and driveway design



Unparged concrete block or concrete masonry units shall not be permitted along any street frontage.

2. General site design

a. Multimodal Transportation

i. Pedestrian circulation shall be defined with paving materials and landscaping and shall connect all uses to one another and to the public sidewalk system.

ii. Bicycle or pedestrian connectivity to adjacent developments is required.

iii. Where no sidewalks currently exist, sidewalks shall be installed with the right-of-way between the property line and the back of the curb.

iv. The minimum width of newly installed sidewalk shall be five feet, except where sidewalks exist on the same side of the block, in which case, the width of newly installed sidewalks shall align with the existing sidewalk width.

b. When new streets are installed, the establishment or continuation of a grid street pattern shall be required. Block lengths within the grid pattern shall not exceed 400 feet between intersecting streets.

3. Trash containment screening

All developments within the UMX are exempt from the buffering and screening requirements of article 5 of this chapter and are instead subject to the following screening requirements:

a. Trash containment areas shall be located within or behind a building.

b. If trash containment, including areas for holding recycling, cannot be accommodated within a building, it shall be placed on the rear or side of the building and shall be completely enclosed and screened from view from rights-of-way, excluding alleys, with an opaque fence or wall. The enclosure shall be at least one foot taller than the highest point of the trash receptacle. Chain link fencing and exposed concrete blocks shall be prohibited.

4. Multiple frontage lots

The following standards apply to lots with three or more frontages.

a. If a lot has frontage along multiple streets, the required primary street shall be that as shown in Figure 18-43.3: UMX primary frontage streets.

i. Where a property does not have frontage abutting a primary street, as shown in Figure 18-43.3: UMX primary frontage streets, one of the frontages shall be designated as the primary frontage along any of the abutting streets.

ii. Where a property has all frontages abutting a primary street as shown in Figure 18-43.3: UMX primary

Figure 18-44.2: Primary building entrance architectural elements

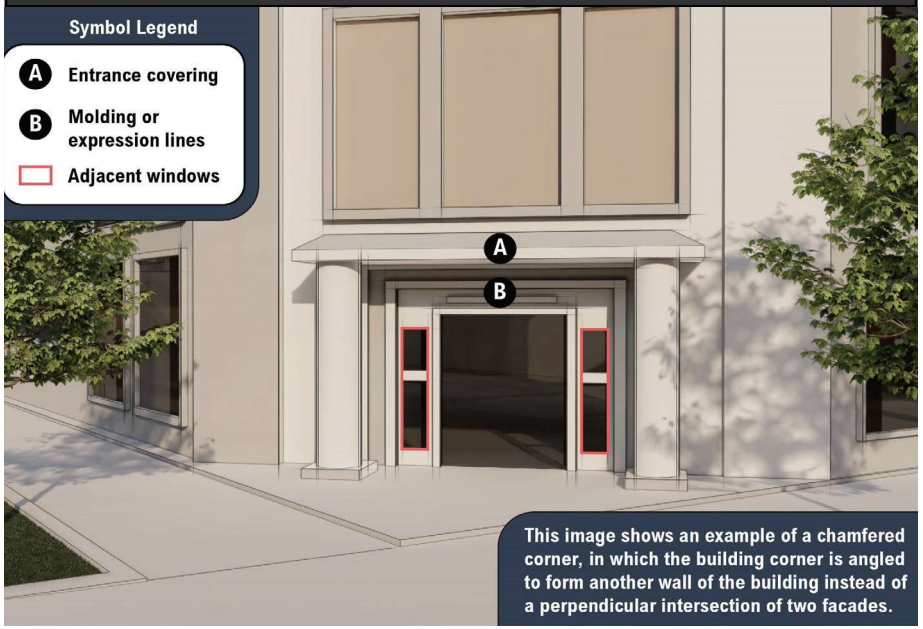


Figure 18-44.3: Primary entrances distance



frontage streets, the primary building orientation shall be along the street with predominant primary frontage treatment on adjacent properties (see Figure 18-43.4: Primary frontage treatment). One frontage may be designated as a secondary frontage.

iii. Frontages not designated as primary shall be designated as secondary frontages. Utilities and parking shall be located along secondary frontages.

b. The minimum fenestration requirement outlined in Section 18-44-A.1.d: Fenestration may be reduced from 50 percent to 30 percent along one secondary frontage street with the inclusion of additional architectural treatment to the facade.

5. Open space

For lots of one acre or more in area, a minimum of 10 percent of total contiguous area shall be set aside as open space.

6. Fences and walls

a. Open wire fencing, including chain link, hurricane fencing, barbed wire, and exposed or unparged concrete block shall be prohibited.

b. In front of buildings, fence height shall not exceed four feet.

7. Parking

Parking at the street level shall be screened from public streets by permanent walls, shrubbery, or hedges at least three feet but not more than five feet in height (see figure 18-44.20: Surface parking illustration).

B. RO district.

The following standards apply to all RO development.

1. Utility and equipment screening

Figure 18-44.4: Building facade transitions

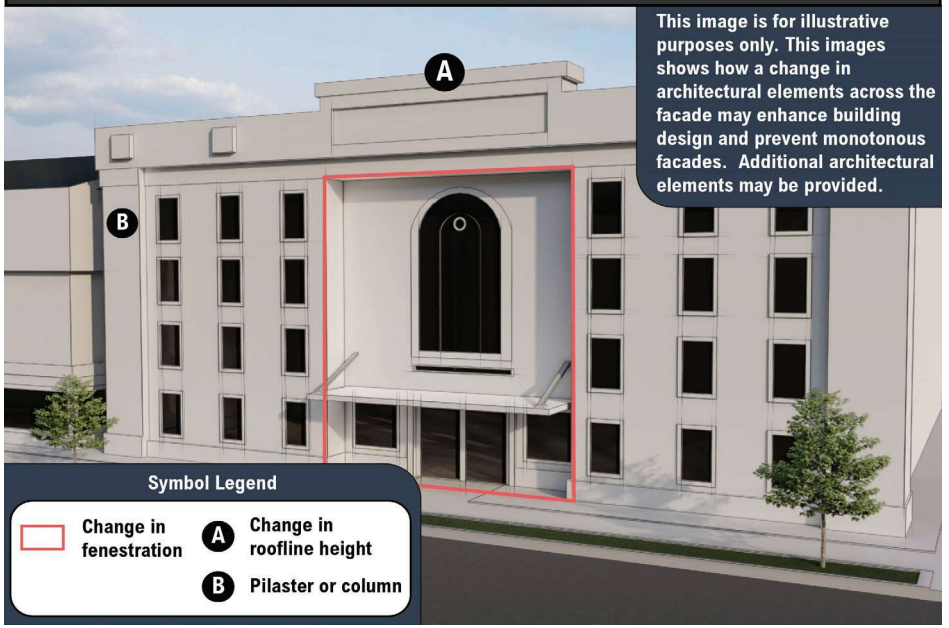
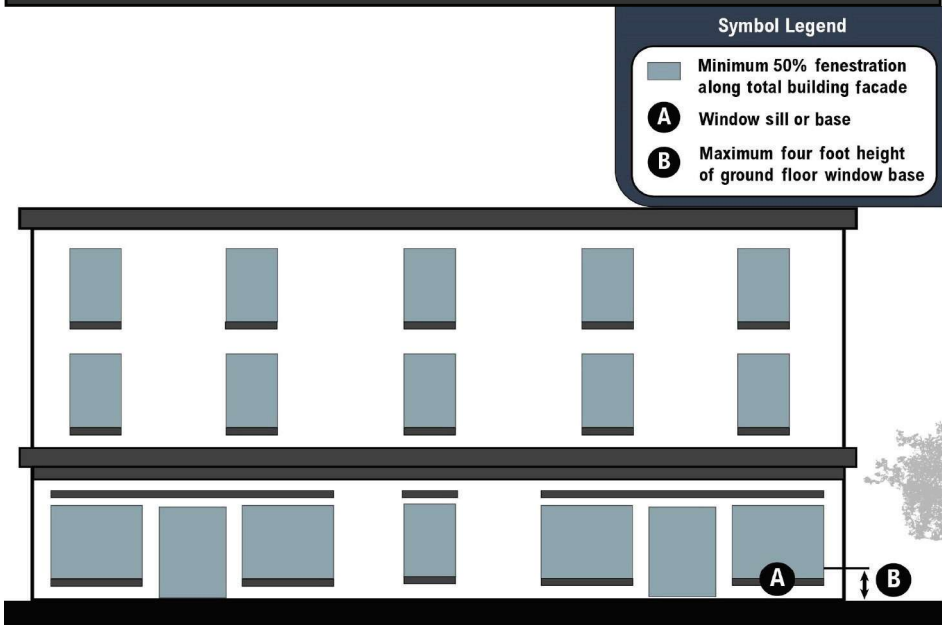


Figure 18-44.5: Building fenestration



Dumpsters shall be prohibited. Trash shall be stored inside or fully behind a principal building until collection.

2. Parking and driveway requirements

   a. Driveway access controls

      Except for detached single-dwelling and duplex dwelling units, cross-access and shared driveways are required,according to the following standards.

      i. No more than one driveway access per lot shall be permitted on Oleander Drive.

      ii. Along Oleander Drive, access shall be shared with all adjacent RO-zoned lots whenever access to Oleander Drive is proposed through the provision of an easement to the adjacent RO-zoned property.

      iii. When driveway access is available on an abutting property, the proposed use shall utilize this access.

      iv. When the nearest edge of an existing driveway on and adjacent RO-zoned lot with frontage on Oleander Drive is within 50 feet of the proposed use, the proposed use shall utilize the driveway on the adjacent tract as a shared access, with an easement to be recorded granting access.

      v. The shared driveway shall be the sole access to the site from Oleander Drive and any existing driveway(s) accessing Oleander Drive shall be eliminated.

      vi. Shared access shall not be required when all possible interconnections between two abutting lots would cross 20 linear feet or more of wetlands or floodplains.

      vii. Shared access via new or existing driveway on a property when shared access cannot be provided via an existing driveway consistent with the requirements of this section, a maximum of one driveway to Oleander Drive shall be permitted on the property. This driveway shall be installed to maximize potential shared access in the future.

      1. The driveway shall be located to maximize connectivity between lots, as approved by the technical review committee. To accommodate required sight distances or preserve environmental features, the driveway shall not be set back from the nearest side lot line more than 40 feet. Shared access shall not be required when all possible interconnections between two abutting lots would cross 20 feet or more of wetlands or floodplains.

      2. Each use shall provide a linear cross-access easement to this driveway guaranteeing access to all abutting lots zoned RO. An accessway may not be blocked off, parked in, or otherwise obstructed. The access easement shall provide access from the closest adjacent property line to the driveway. The easement between the driveway and the closest adjacent lot shall be in a location best suited for connection to the adjacent lot, shall be located behind the primary building, and shall be a minimum of 12 feet wide. The technical review committee may waive the cross access requirement if it would cause five or more contiguous lots to be interconnected.

      3. Existing driveways not meeting the requirement of this section shall be eliminated during the redevelopment/conversion of the property.

      4. The location of the driveway intersection with Oleander Drive and with the easement connection to the adjacent lot shall be subject to approval by the technical review committee based on the potential to minimize the need for future driveways, preserve

existing buildings and trees, and maximize the distance from the existing street and driveway intersection, including consideration of safe sight distances.

5. Parking shall not be permitted along shared driveways between Oleander Drive and the rear edge of the easement granting access to the abutting lot.

b. Access to alley

For lots along the north side of Oleander Drive that are redeveloped/converted to nonresidential uses, motor vehicle access to the alley is not permitted.

c. Access easements

Access easements for parking aisles and driveways guaranteeing access and use to all abutting lots within the

RO district shall be required, except for detached single dwelling and duplex units.

d. Parking standards

i. Parking is not permitted between the principal building and Oleander Drive. Where building placement and any required minimum buffer do not allow a minimum of 20 feet in width to provide driveway access to the rear site and a shared driveway is not possible, this requirement may be waived by the technical review committee.

ii. Off-street parking surfaces shall be of pervious materials where soils are suitable.

iii. All parking areas shall be screened from any adjacent single-dwelling zoned lots and along the alley north of Oleander Drive. Screening shall be a minimum of a 10- foot-wide vegetative buffer and solid six-foot tall wood fence. A minimum of one row of planted materials consisting of a combination of trees and shrubs shall be provided at a minimum height of three feet at planting and give at least 50 percent opacity of the fence at planting. To provide a variety of height and depth, at least one tree on average shall be planted for every 30 linear feat of screening.

3. Nonresidential uses and conversions

Existing exterior features, including roof pitch, building setback, fenestration, massing, and scale shall be retained when buildings are converted or redeveloped.

4. Grading

Grading of a site to modify topography is not permitted except to correct drainage problems, as approved by the technical review committee.

5. Building design

New construction, including additions to existing buildings, shall comply with the following (see Figure 18-44.6 RO building design):

a. No additions to existing buildings shall be made to the front or side(s) of the building.

b. The maximum building footprint for any new principal building shall be 2,100 square feet, whether by an addition or by new construction. The building footprint may be increased to 3,000 square feet, whether by new construction or addition, if:

i. The lot area is at least 20,000 square feet; and

ii. All parking is located behind the building.

c. Additions and extensions shall maintain the character of the existing buildings and shall include design elements that are consistent with the block in terms of massing, scale, fenestration, and roof pitch. Except for detached singled welling and duplex dwelling units:

i. The Oleander Drive-facing elevation shall be the primary entrance and shall include a functional pedestrian entrance.

ii. Roof pitch shall be at least 4/12.

iii. Windows shall extend from a sill or base not to exceed four feet in height above the adjacent grade. Darkly tinted, mirrored, and opaque windows that block two-way visibility are prohibited along street-level facades.

iv. Exterior burglar bars, fixed riot shutters, and similar security devices shall not be visible from the public right-of-way. Mirrored and reflective glass shall be prohibited.

v. For at least 51 percent of the exterior of the building facade, building materials shall be limited to:

1. Wood siding or shingles;

2. Brick;

3. Stacked stone; and

4. Fiber cement siding or shingles.

Figure 18-44.6: RO building design

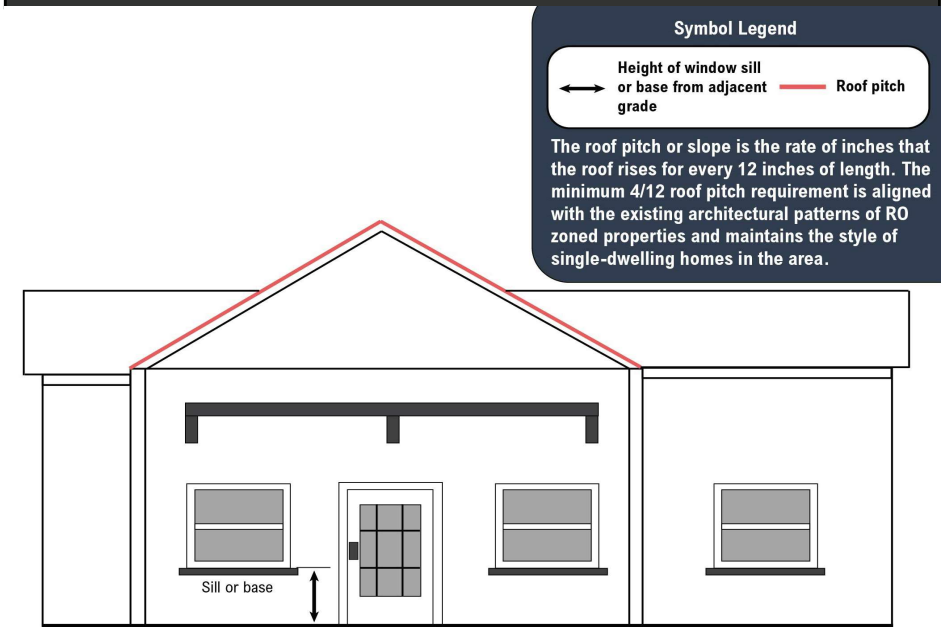
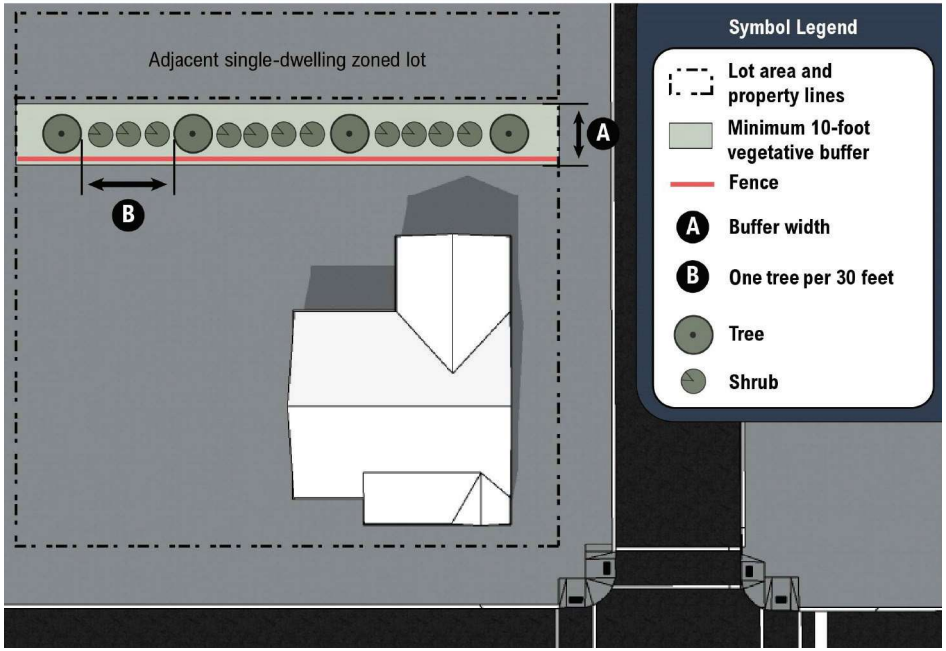


Figure 18-44.7: RO outdoor standards



6. Landscaping and buffers

   a. Any redevelopment or conversion of a building to triplex, quadraplex, or nonresidential use shall be subject to the parking lot landscaping of Section 18-321: Parking lot landscaping, and Section 18-319: Streetscape landscaping requirements. Preservation of natural stands of trees and native vegetation may be substituted for interior landscaping requirements when the square footage of the preserved areas is at least equal to the minimum square footage for new landscaping.

   b. Any redevelopment or conversion of a building to nonresidential use shall require a buffer of at least 10 feet in width of vegetation and a solid six-foot tall wood fence adjacent to single-dwelling zoned lots. A minimum of one row of planted materials consisting of a combination of trees and shrubs shall be provided at a minimum height of three feet at planting and be at least 50 percent opaque at the time of planting. To provide a variety of height and depth, at least one tree on average shall be planted for every 30 feet of buffer (see Figure 18-44.7: RO outdoor standards).

C. CBD district. The following standards apply to all CBD development.

1. Building placement

a. Pedestrian-oriented spaces

Maximum setbacks may be voluntarily increased and minimum frontage buildouts may be decreased to provide one of the following types of pedestrian-oriented spaces, provided that a forecourt, plaza, or arcade is installed, subject to the following criteria:

i. Forecourt

1. Up to 50 percent of the building wall may setback a maximum depth of 15 percent of the building height (see figures 18-44.8: Forecourt dimensions and

18-44.9: Forecourt example).

2. Non-planter areas of the forecourt shall be surfaced with materials approved by the city engineer, such as concrete, brick, or stone pavers.

ii. Plaza

1. Plazas shall not occupy more than 25 percent of the lot area (see figures 18-44.10: Plaza dimensions and

18-44.11: Plaza example).

2. Plazas shall be surfaced with materials approved by the city engineer, such as concrete, brick, or stone pavers.

3. Non-paved areas of the plaza shall be landscaped.

4. Canopy or understory trees may be provided at a maximum rate of one tree per 1,200 square feet of plaza area.

Figure 18-44.8: Forecourt dimensions



Figure 18-44.9: Forecourt example



5. Trees and additional vegetation in the plaza shall meet the general landscaping requirements of article 5 of this chapter.

6. Seat deterrents such as spikes or rails are prohibited.

7. No driveways, parking spaces, passenger drop-off, garage entrances, loading areas, mechanical equipment, dumpsters, or trash compactors shall be located within a plaza.

iii. Arcade

1. The ground floor building face may be recessed up to 20 feet from the property line (see Figure 18-44.12 Arcade dimensions and 18-44.13 Arcade example).

2. There shall be a minimum of 10 feet of clearance between the ground surface and the underside of the arcade roof.

3. Arcades shall not encroach on a public right-of-way.

2. Sidewalks

a. North of Red Cross Street, where no sidewalks currently exist, sidewalks shall be installed within the right-of-way at a minimum width of 12 feet between the property line and the back of the curb (see Figure 18-44.14: CBD sidewalks north of Red Cross Street).

b. Within the CBD, where sidewalks exist on the same side of the block, the width of newly installed sidewalks, including existing sidewalk that is removed and replaced, shall align with or be greater than the existing sidewalk width.

Figure 18-44.10: Plaza dimensions

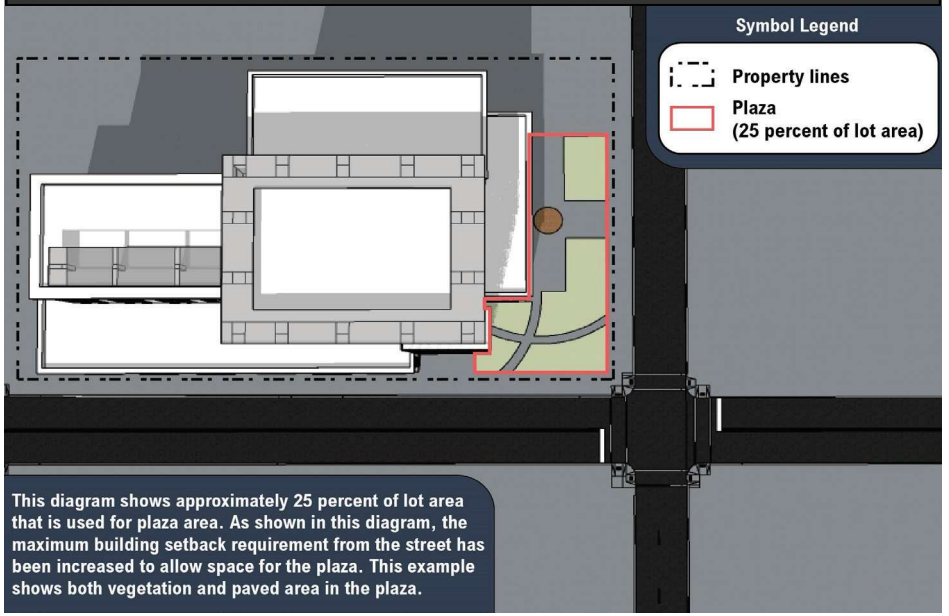


Figure 18-44.11: Plaza example



3. Building height

   a. Except for the provisions for build-back following demolition of contributing buildings, building heights shall be permitted according to Figure 18-43.9: CBD by-right height map.

   b. Height restriction for demolition of buildings with contributing historic resource status. If the owner of a building identified as contributing in the National Register of Historic Places inventory elects to demolish it, building height for new construction shall be limited. Any new building or portion thereof within the footprint of the demolished contributing historic building shall be subject to the following additional restrictions:

      i. The height of any new building shall be restricted to the height of the demolished historic building plus half of the difference between the height of the demolished building and the by-right height prescribed in figure 18-49.9: CBD by-right height map.

      ii. For the purposes of this section, the height of the existing building shall be measured from the average adjacent sidewalk elevation to the highest point of the parapet, or in the case of a building with a sloped roof, to the average roof height.

      iii. Properties located within the CBD-historic district overlay (CBD-HDO) shall be subject to review by the historic preservation commission, per article 7 of this chapter.

      iv. Removal of build-back height restriction

   c. To retain all allowable building height, a property owner demolishing a contributing building may make application to remove the height restriction according to the steps outlined in Section 18-597: Historic preservation.

Figure 18-44.12: Arcade dimensions

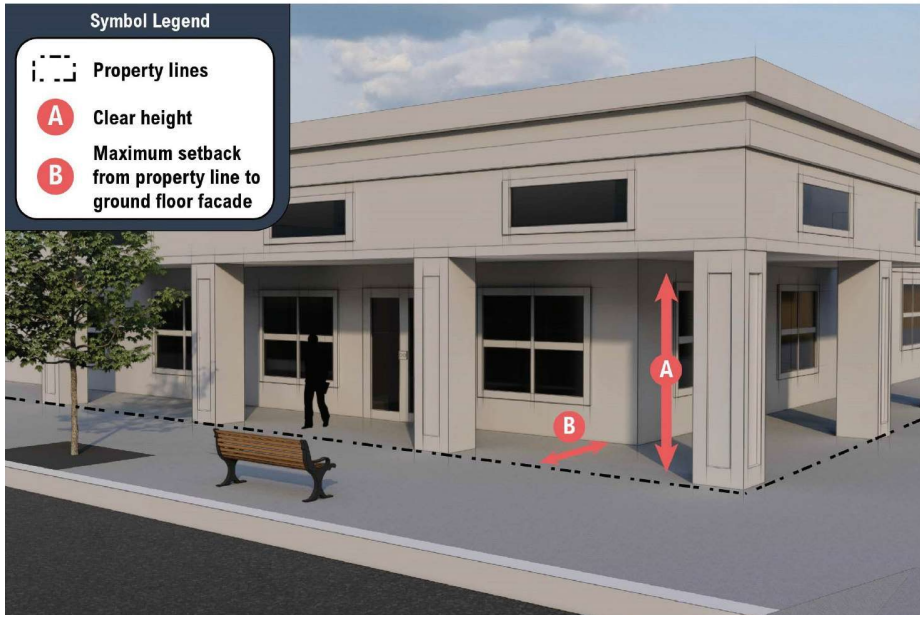


Figure 18-44.13: Arcade example



An arcade allows a building to frame the street with a minimal setback while providing a covered walkway along the ground floor. This walkway may serve as an additional amenity area, such as outdoor seating or dining.

d. If height restriction is removed, the by-right height prescribed on the CBD by-right height map (Figure 18-43.9) may be allowed for new construction.

e. If the city adopts a condemnation ordinance for the building pursuant to the provisions of Chapter 16 of the city of Wilmington Code of Ordinances, the contributing historic resource status shall be removed for the purpose of this section upon adoption of the ordinance.

v. Redevelopment with preservation of historic building facades

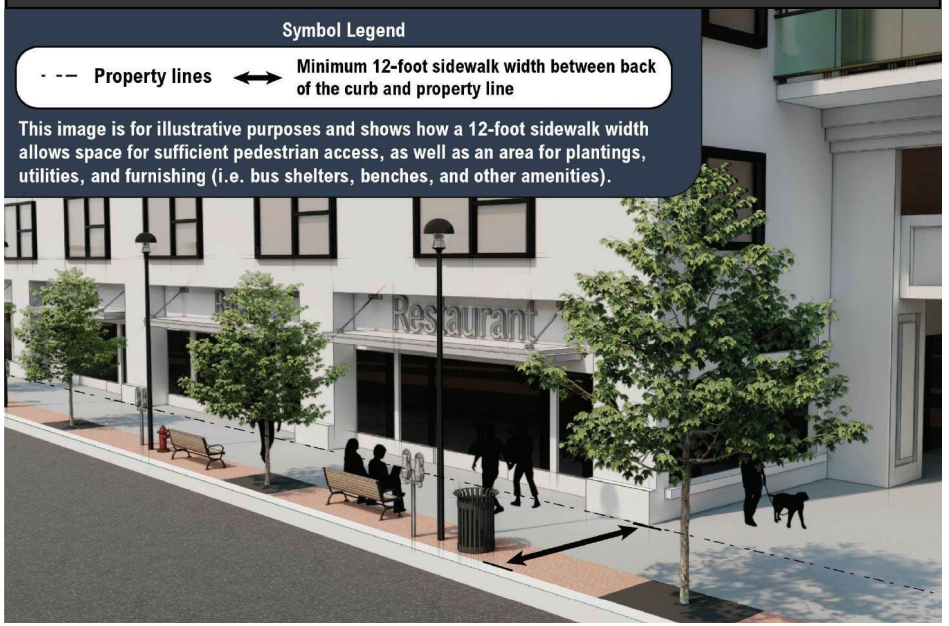
a. To retain all allowable building height, building facade(s) fronting on any public street shall be preserved. For purposes of this section, a facade includes the building's exterior finish materials and veneer, fenestration, exterior embellishment, and the wall structure that serves as the substrate for the aforementioned items.

b. Within the CBD-HDO, demolition and new building design must be approved by the historic preservation commission.

c. The height of any new construction above and behind the preserved facade(s) shall be allowed up to the maximum building height shown in Figure 18-43.9: CBD by-right height map.

d. For the purposes of this section, construction that is taller than the preserved historic facade(s) shall be stepped back a minimum of eight feet from the face of the facade(s).

Figure 18-44.14: CBD sidewalks north of Red Cross Street



e. If the depth of the lot is greater than 80 feet, the new construction that is taller than the preserved facade(s) shall be stepped back a distance equal to 10 percent of the depth of the lot up to a maximum 20 feet (see figures 18-44.15: Building step-back with preserved facades and 18-44.16: Lot depth for build-back with preserved facades).

vi. The height of any new construction above and behind the preserved facade(s) shall be allowed up to the maximum building height shown in Figure 18-43.9: CBD by-right height map.

vii. For the purposes of this section, construction that is taller than the preserved historic facade(s) shall be stepped back a minimum of eight feet from the face of the facade(s).

viii. If the depth of the lot is greater than 80 feet, the new construction that is taller than the preserved facade(s) shall be stepped back a distance equal to 10 percent of the depth of the lot up to a maximum 20 feet (see figures 18-44.15: Building step-back with preserved facades and 18-44.16: Lot depth for build-back with preserved facades).

ix. If more than one facade of a building fronts on a right-of-way, the 10 percent step-back (with 20 feet maximum) shall apply to new construction behind the facade fronting the greater property depth and only an eight-foot setback shall apply to construction behind any other facade fronting a right-of-way.

x. In the case of recombined lots of varying depth, an average depth measurement may be utilized in determining the step back, or alternatively, the new construction above the preserved facade may have varying step backs relative to the property depths.

xi. Balconies and other similar architectural elements may encroach into the required new construction step back up to a distance equal to 25 percent of the step back depth, but in no case may these elements encroach into the eight-foot minimum step back.

Figure 18-44.15: Building step-back with preserved facades

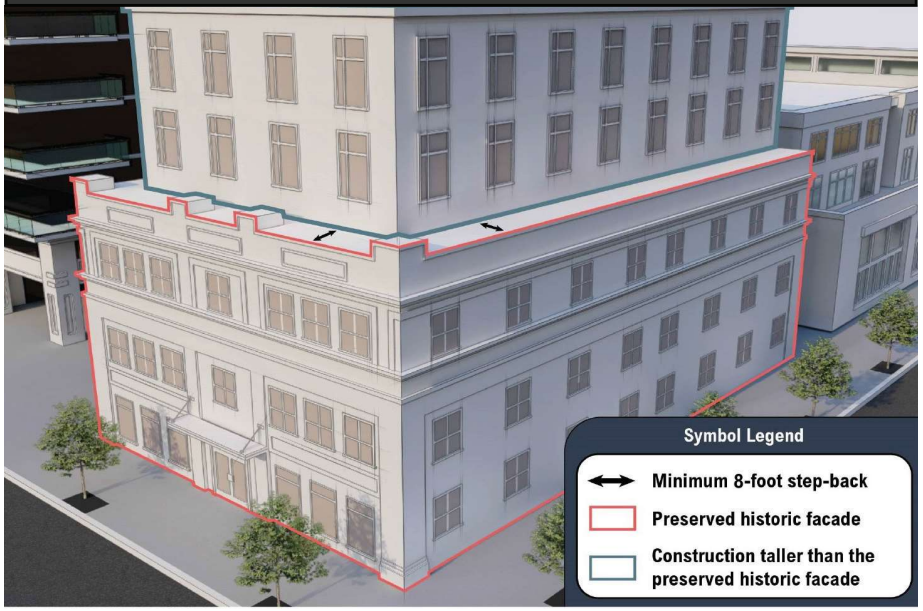
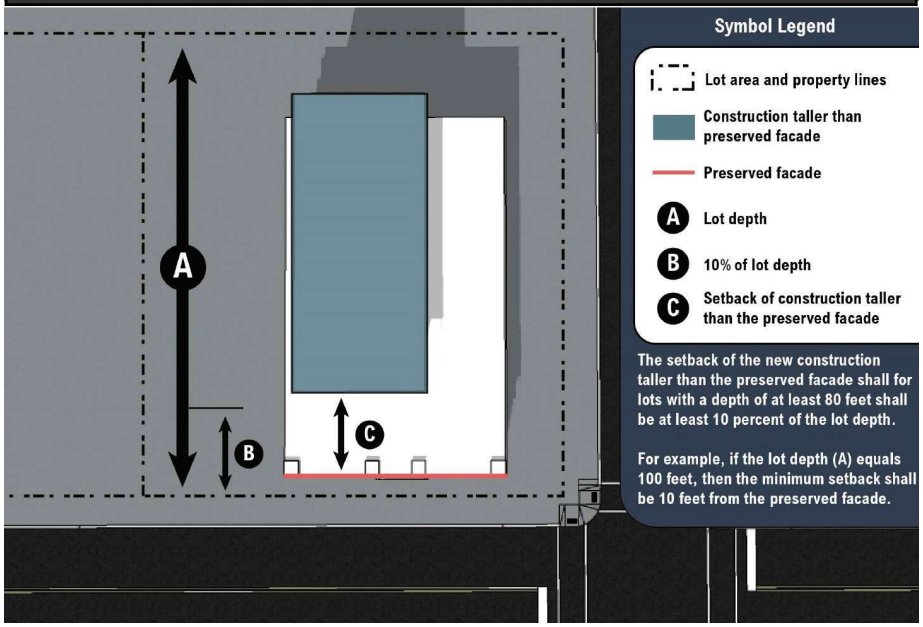


Figure 18-44.16: Lot depth for build-back with preserved facades



xii. The roof of the contributing building that is within the step back area may be utilized as an open air, aboveground plaza unless historic features of the building would be obscured by any physical elements necessitated by the use.

xiii. If the lot is developed with a contributing historic building that is a one-story or two-story wood frame dwelling, the dwelling may be relocated in lieu of preserving the facade in order preserve the maximum permitted building height.

f. Demolition requirements and procedures. For demolition of all or a portion of a contributing historic building for which the contributing status has not been removed, the following requirements and procedures shall apply.

i. Prior to city sign-off of a demolition permit, the following shall be required:

1. Either a site plan or a greenspace plan shall be submitted to and approved by the technical review committee.

2. A site plan shall be submitted that complies with the provisions of Section 18-588: Site plans and all other applicable provisions of this chapter, and the *Technical Standards and Specifications Manual*.

3. A greenspace plan shall indicate seeding or sod over at least 80 percent of the lot, grading to prevent significant ponding of water, and retention of existing sidewalks or replacing if damaged or removed. The greenspace shall remain in place until such time as the site is developed.

4. A financial guarantee or surety in an amount satisfactory to replace sidewalks and curbing, install erosion control features and grass, and maintain the site as a green space for a period of two years from submittal of the financial guarantee to the city. The financial guarantee or surety shall be in a form approved by the city attorney.

ii. During and after demolition, the following shall be required.

1. All slabs and foundations shall be removed during building demolition unless they are to be incorporated into the new construction or unless a report of structural inadequacy prepared and sealed by a structural engineer licensed in the State of North Carolina demonstrates that removal would create a public safety hazard.

2. Silt fencing sufficient to prevent silt from washing into the public right-of-way until permanent seeding is established shall be install immediately following demolition.

3. The site shall be graded level to within one-tenth of a foot and install other erosion control measures, including temporary seeding of grass of a type approved by the city manager, within 30 days following completion of demolition.

4. Construction shall begin on the new development within 180 days of completion of demolition, with one 30-day extension allowed for circumstances beyond the control of the property owner as determined by the city manager. For purposes of this subsection, a parking lot as approved by the city is considered new development, but in no case shall the unimproved site be used for vehicle parking or storage.

5. The site shall be maintained in a well-kept manner and shall not create a public nuisance as set forth in chapter 10 of the city of Wilmington Code of Ordinances. Maintenance of the site includes, but is not limited to, removal of debris and trimming and upkeep of grass.

6. If, after 180 days from demolition and the expiration of any approved extensions, no construction has begun, the property owner shall replace any sidewalks that were removed or damaged, as well as remove chain link or other construction fencing and replace with a railing or fencing type approved by the city, within 30 days.

iii. Post-demolition procedures. After demolition, the following procedures shall be required for the site:

1. Implementation of the approved green space plan shall occur within 60 days of demolition, including planting and maintaining permanent seeding or sod, grading, and replacing sidewalks, as indicated on the approved plan; and

2. Any slopes or drop-offs exceeding five percent shall be cordoned with a railing, as approved by the technical review committee on the site or greenspace plan. If fencing is needed for screening or security, the fence shall be indicated on the site or greenspace plan and approved by the technical review committee. Chain link fencing shall be prohibited for this purpose.

4. Multiple frontage lots

a. Primary frontage streets For lots with three or more street frontages, one street frontage shall be designated as a primary frontage street that applies front facade standards.

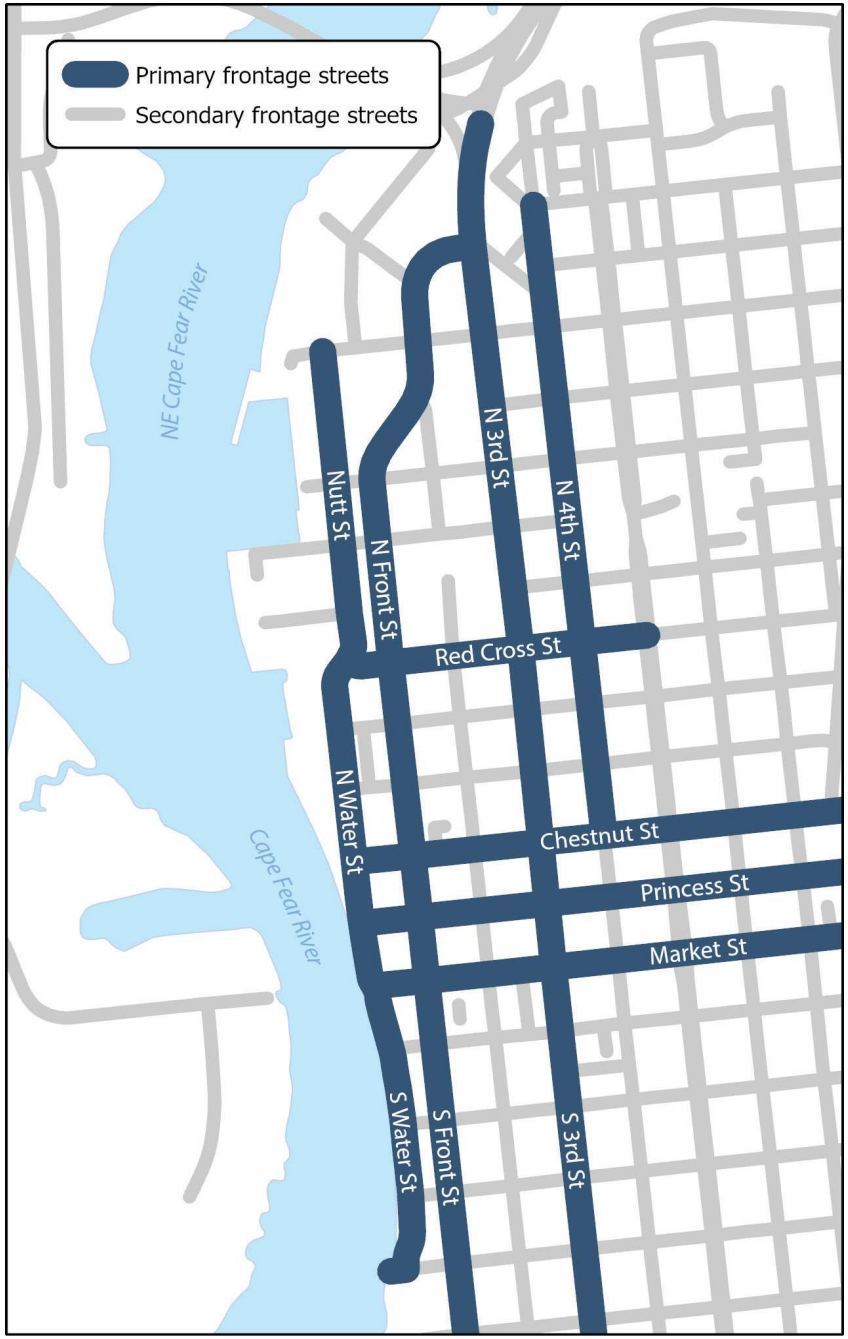
i. The following factors shall be used to determine which streets shall be designated as primary frontage streets:

1. Any street shown as a primary frontage street in Figure 18-44.15: CBD primary and secondary frontage streets shall be designated as a primary frontage street.

2. If a lot has no adjacent primary frontage street designated in Figure 18-44.17, a primary frontage street shall be designated on the street adjacent to the blockface with the greatest number of buildings with street frontage (see Figure 18-44.18: Blockface orientation).

3. If all the streets adjacent to a lot are designated as primary frontage streets in Figure 18-44.15, a secondary frontage street shall only be designated along the blockface with the least number of buildings with street frontage (see Figure 18-44.16: Blockface orientation).

Figure 18-44.17: CBD primary and secondary frontage streets



ii. The following shall be prohibited along primary street frontages:

1. New alleys;

2. New driveways;

3. Ground-floor parking, structured or surface within 20 feet of the primary street frontage; parking decks shall be permitted if the ground-floor, street-facing facade is lined with active uses;

4. Dumpsters; and

5. Trash compactors.

b. Secondary frontage streets

Non-primary frontage streets shall be designated as secondary frontage streets to which secondary street standards are applied.

i. One secondary frontage street may be exempt from meeting the maximum side street setback and minimum frontage buildout requirements.

ii. The minimum fenestration requirement outlined in Section 18-44-C.2.d: Fenestration may be reduced from 50 percent to 30 percent along one secondary frontage street with the inclusion of additional architectural treatment to the facade outlined in this section.

5. Parking

All off-street parking shall adhere to the following requirements.

a. Surface parking shall be set back a minimum of 10 feet from the front plane of all street-facing facades (see Figure 18- 44.19: Surface parking location) and shall not be located between a building and the street.

b. Parking at the street level shall be screened from public streets by permanent walls, shrubbery, or hedges at least three feet but not more than five feet in height (see figure 18-44.20: Surface parking illustration).

c. Surface parking shall be accessed via existing public or private alleyways, where they exist or are proposed.

d. All surface parking lots shall meet the parking lot landscaping requirements of Section 18-321: Parking lot landscaping.

Figure 18-19: Surface parking location

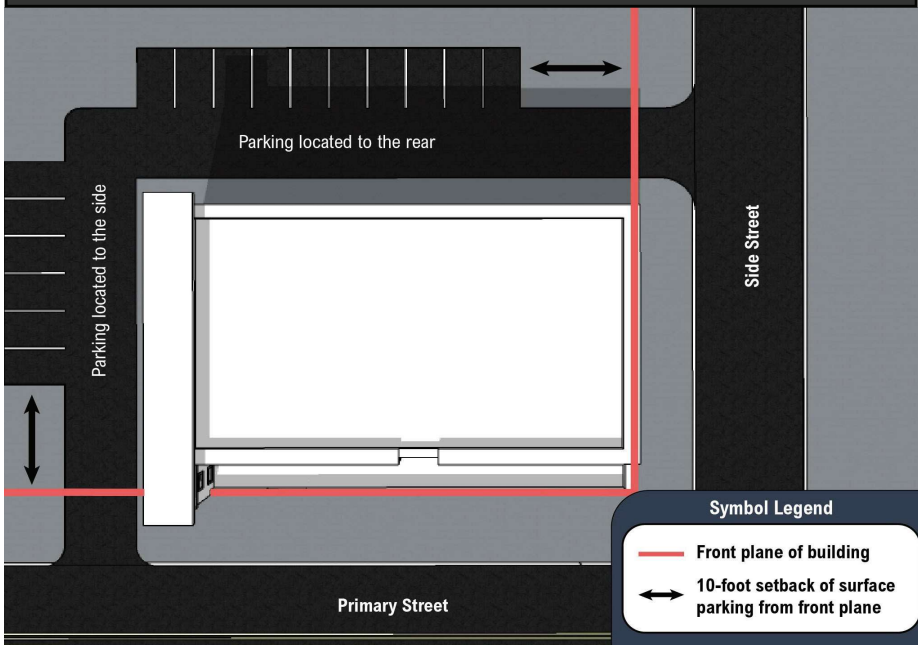


Figure 18-44.18: Blockface orientation

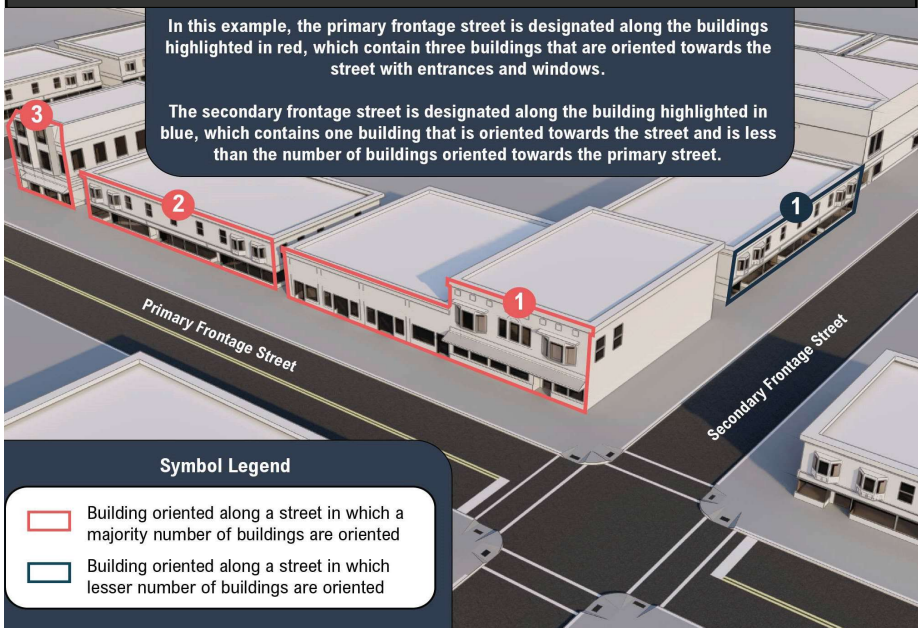


Figure 18-44.20: Surface parking illustration



6. View corridors

   a. All developments shall provide and protect view corridors of the Cape Fear River along existing or proposed streets that terminate at the river.

   b. View corridors shall remain fully unobstructed by buildings or structures from the ground to the sky.

   c. Along any new street that terminates within 50 feet of the riverwalk, a clearly defined, publicly accessible pedestrian path shall be provided as an entry point to the riverwalk. In the case where a property is located between the street and the riverwalk, a pedestrian path shall be provided from the street to the abutting property line (see figures 18-44.21: View corridors and 18-44.22: Public access to riverwalk).

7. Trash equipment screening

   All developments within the CBD are subject to the following screening requirements.

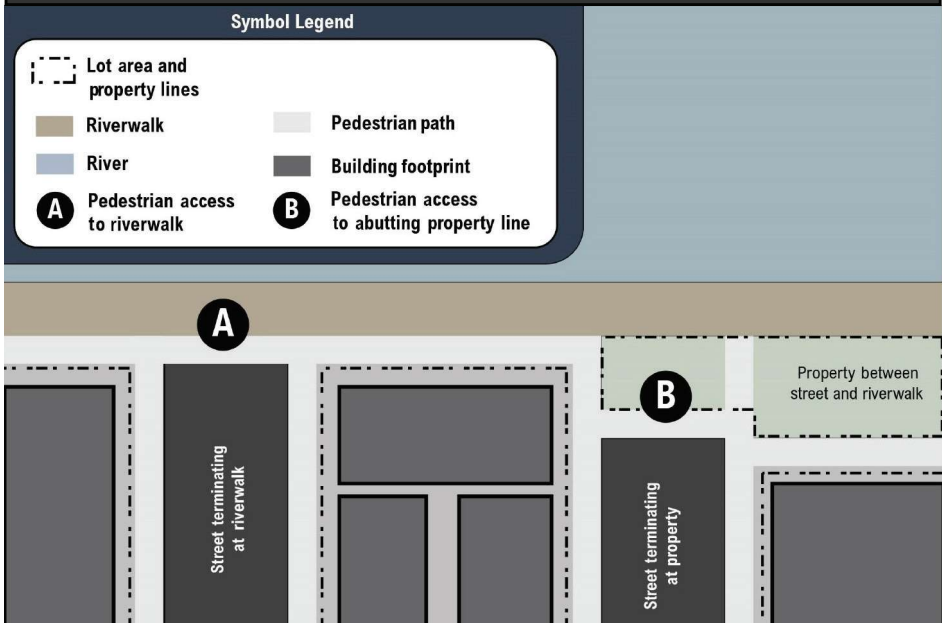
   a. Trash and recycling containment areas shall be located within a building.

   b. If trash and recycling containment cannot be accommodated within a building, it shall be placed on the rear or side of the building and screened from view from the right-of-way, subject to the provisions of Section 18-324: Screening for dumpsters, equipment, and outdoor storage areas.

Figure 18-44.21: View corridors



Figure 18-44.22: Public access to riverwalk



8. Electric and communication utilities

   a. Any required utility easements shall be along rear or side lot lines.

   b. The width of such easements shall be based upon the type of utility installed and the area required for adequate maintenance of those utilities.

   c. Electric power lines shall be buried unless the following criteria are met:

      i. The power lines existed above ground at the time of first approval of the development plan, whether the lines are subsequently relocated during the construction of the development plan; and

      ii. The power lines are located outside the boundaries of the subject lot or lots containing the development.

9. Building design

   a. All new construction in the CBD shall comply with the following design standards where applicable. Within the historic district overlay, building design is subject to review by the historic preservation commission.

   b. Exceptions to these standards may be approved by the design adjustment committee.

   c. When considering exceptions to these standards, the design adjustment committee shall consider whether adequate and safe public access would be provided, any demonstrated historic development or design patterns based on photographic or other evidence, and the character of the surrounding area.

   d. Building entrances

      i. Primary building entrances

         1. Primary building entrances shall be provided along street fronting facades at a minimum rate of one entrance per 100 feet (See Figure 18-44.23: Primary building entrance rate along facade).

         2. Primary building entrances shall be clearly defined and distinctive by using at least two of the following architectural elements (see Figure 18-44.22: Primary building entrance architectural elements):

            i. A recession of the entrance of at least five feet;

            ii. Entrance cover, no higher than the second story, such as awnings, overhangs, canopies, or eaves;

            iii. A chamfered corner;

            iv. Sidelight, transom, or adjacent windows;

            v. Additional moldings with expression lines; or

            vi. A bay of unique width.

      ii. Secondary outside building entrances to upper floors, if located on the front facade, shall align with the outermost window on the front facade (see figures 18-44.24 and 18-44.25: Aligned second story entrance examples).

   e. Massing and scale

      i. Expanses of blank walls facing streets (excluding alleys) or public civic spaces may not exceed 20 feet in length.

      ii. Building facades shall incorporate periodic transitions across the facade as stated by incorporating the following elements:

1. Building facades shall be divided into distinct massing elements utilizing at least two methods including, but not limited to:

   i. Facade offsets with each offset between 20 percent and 30 percent of the total length of the facade;

   ii. Building projections such as pilasters, columns, and awnings;

   iii. Change in building materials;

   iv. Change in roofline; and

   v. Change in fenestration (see Figure 18-44.26: Massing and scale).

2. Transitions shall be no farther apart than two thirds of the height of the facade.

vi. Upper floor step backs

1. Buildings with more than eight floors shall step back the upper floors of the building a minimum 15 feet from street facing facades.

2. The upper floor step back shall begin between the fourth and eighth floors (see Figure 18-44.27: Upper floor step backs).

vii. The exterior expression of the ground floor shall be delineated by methods including, but not limited to:

1. Incorporation of a distinct horizontal architectural member;

2. Facade offsets; or

Figure 18-44.23: Primary building entrance rate along facade

Primary building entrances shall be provided at a minimum rate of one entrance per 100 linear feet along street fronting facades.

Primary building entrances placed at multiple locations along large buildings increases pedestrian accessiblity. Furthermore, multiple options for ingress and egress are provided in case of an emergency.

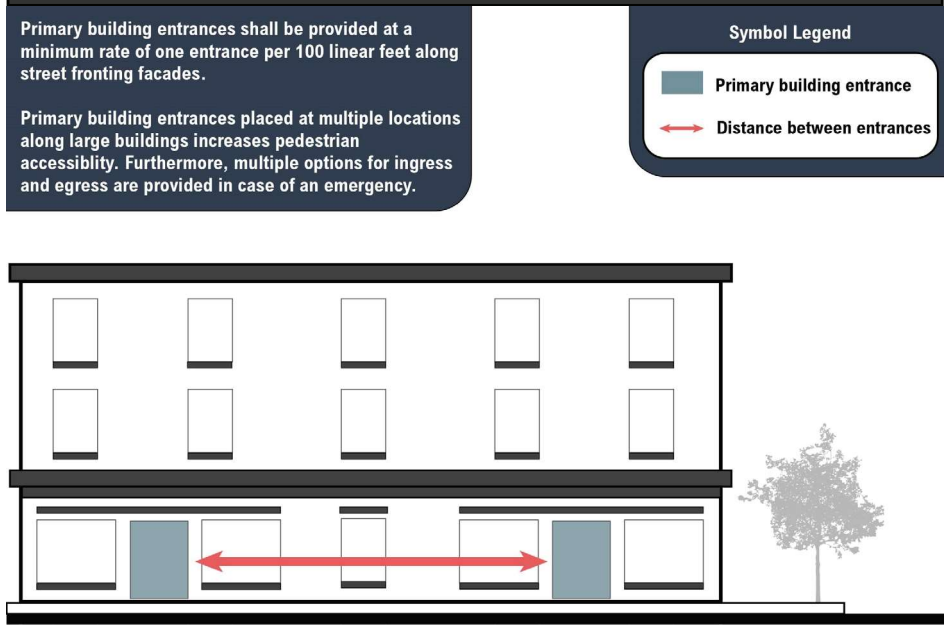


Figure 18-44.24: Aligned second story entrance example



3. A change in materials (not solely color) or fenestration.

viii. A vertical transition shall be provided between the ground floor and upper stories by utilizing one of the following methods:

1. Building projections such as pilasters, columns, and awnings; or

2. Additional moldings with expression lines.

ix. Flat roofs shall be enclosed by a parapet that is a minimum of three feet in height.

f. Street-level facades

i. New buildings shall front onto public sidewalks to reinforce pedestrian activity along public streets and pedestrian ways in at least one of the following ways:

1. Architectural treatment as outlined in this section; or

2. Providing pedestrian-oriented space outlined in this section.

ii. Fenestration

1. A street-level facade that faces a public street, riverwalk, or sidewalk shall have a minimum fenestration area of 50 percent of the facade area (see figure 18-44.28: Fenestration).

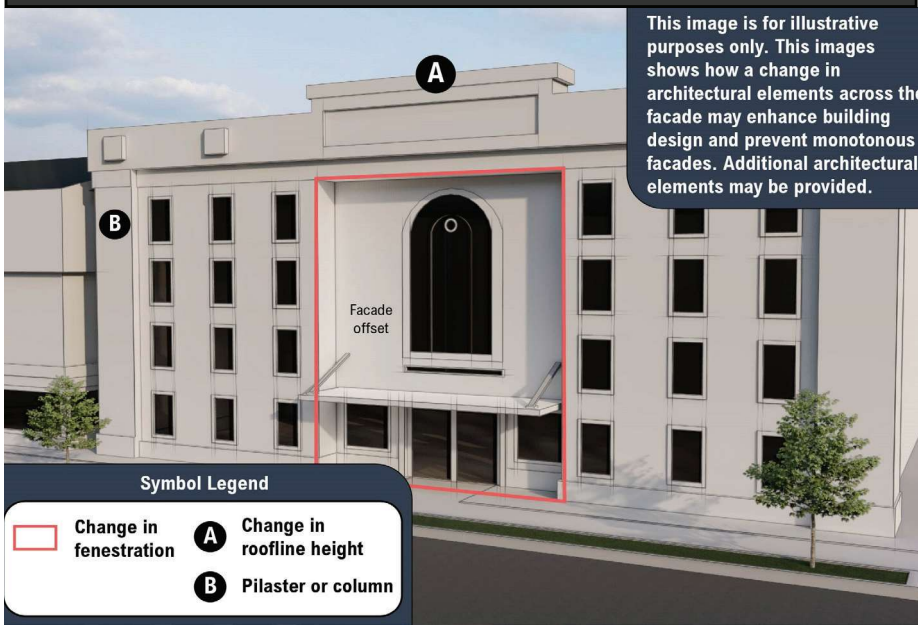
2. Windows may extend from a sill or base. Any sill or base shall not exceed four feet in height from the adjacent grade.

3. Glass shall be transparent with a maximum 15 percent reflectivity. Window tinting and interior affixed window shades that create a permanently opaque

Figure 18-44.25: Aligned second story entrance example detail



Figure 18-44.26: Massing and scale



or translucent condition are prohibited. Spandrel or colored glass may be used in transom areas above door headers only.

4. Exterior burglar bars, fixed riot shutters, or similar security devices shall not be visible from the public right-of-way.

iii. Residential uses shall be prohibited on the ground floor fronting the Riverwalk. North of Orange Street, residential uses shall be prohibited on the ground floor fronting Water and Front streets.

g. Exterior building materials

The following materials are prohibited as primary building materials:

i. Vinyl siding;

ii. Shingle siding;

iii. Faux wood-grained materials;

iv. Metal; and

v. Unparged concrete block.

h. Alterations to historic facades

Alterations or additions to buildings and structures that are designated as contributing resources to the Wilmington National Register Historic District or are more than 50 years old, should apply the Secretary of the Interior's Standards for Rehabilitation. These standards are included in the *Wilmington Design Standards for Historic Districts and Landmarks*.

i. Additional treatments

Figure 18-44.27: Upper floor step backs

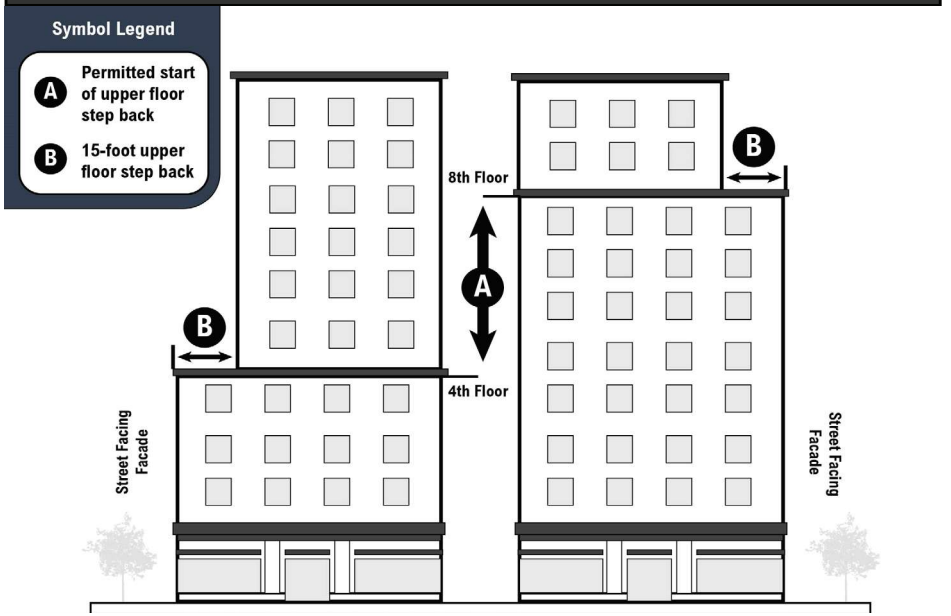
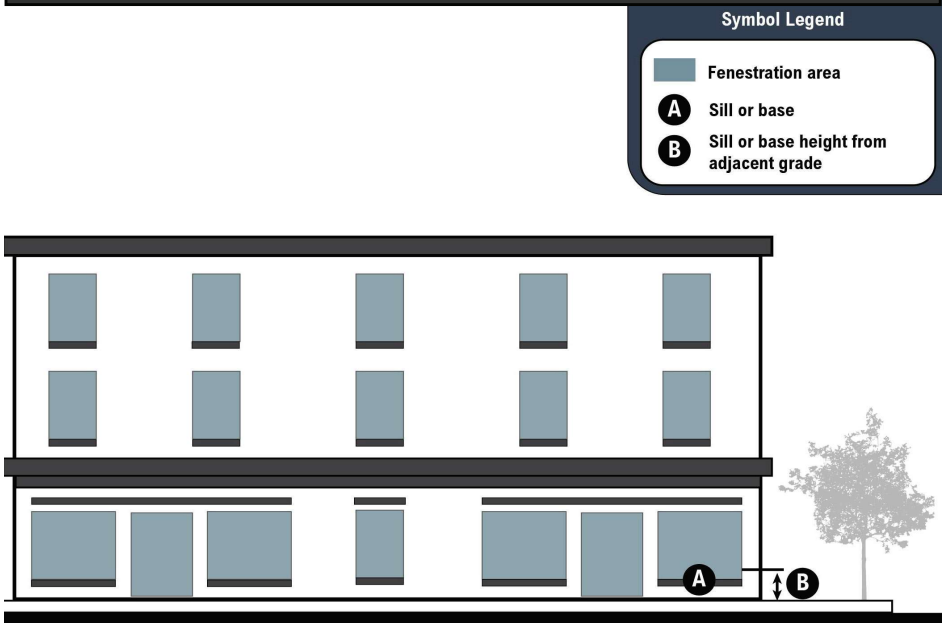


Figure 18-44.28: Fenestration



i. Heating, ventilation, and air conditioning equipment, air conditioning window units, and other electrical equipment shall not be located on street frontages.

ii. All such equipment shall be placed in the side interior of the building, in the rear of the building, or on the roof of the building and screened from the right-of-way.

iii. Through-wall mechanical units are permitted on any facade if they are incorporated into the design of the building, flush with the facade on which they are located, concealed by a vent cover, and have an internal drip system for condensation.

iv. Utility meters, transformers, and fixed trash disposal receptacles that cannot be concealed from the public right-of-way shall be screened with an opaque fence or wall.

10. Special character areas

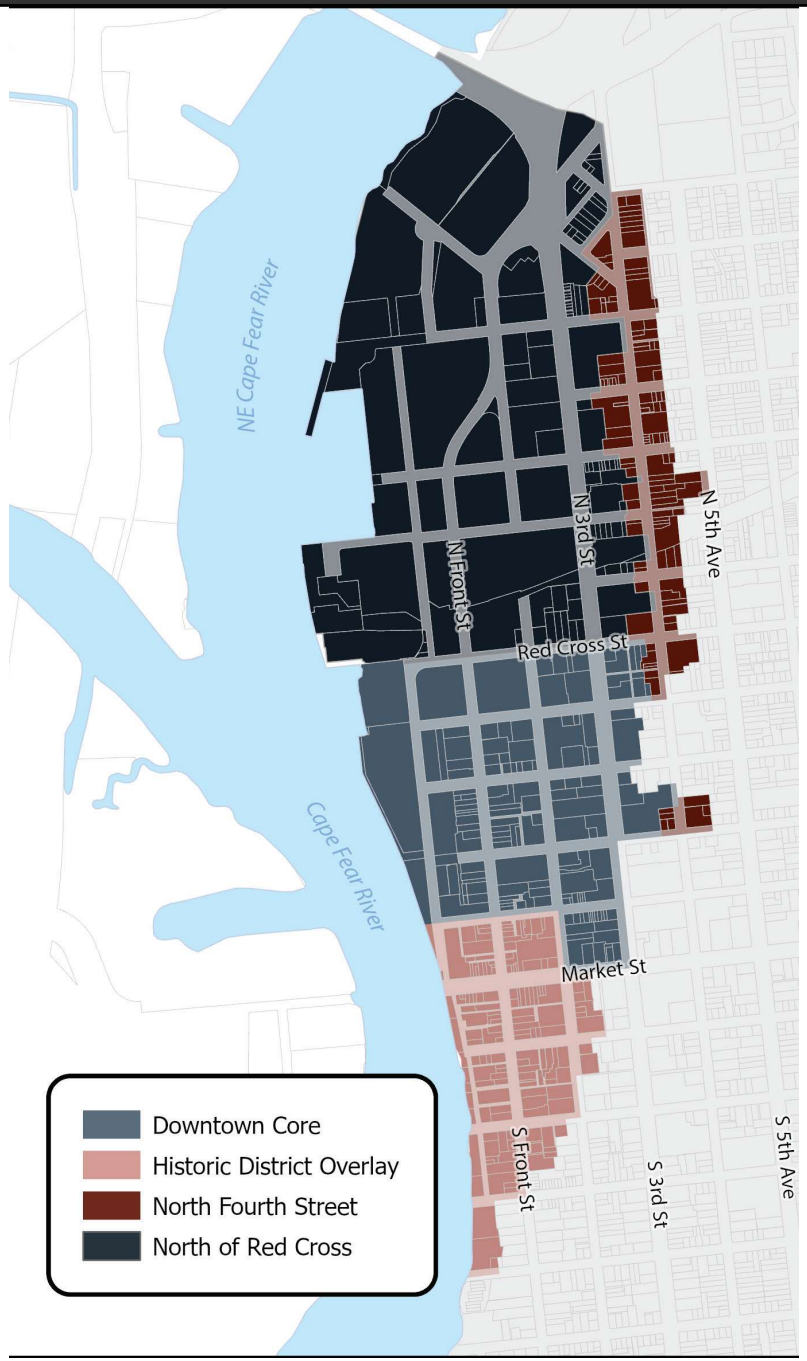
Four distinct character areas comprise the CBD: downtown core, historic district overlay, N. 4th Street, and north of Red Cross Street (see Figure 18-44.29: CBD special character areas). These special character areas are subject to the following additional provisions.

a. North of Red Cross Street

i. In the area north of Red Cross Street, lots are often large, sometimes all or most of a block. This area is suited for dense development with a mix of prominent buildings and grand public spaces that define the urban landscape (see Figure 18-44.30: North of Red Cross Street example.

ii. All residential uses shall be prohibited on the ground floor facing any right-of-way.

Figure 18-44.29: CBD special character areas



iii. For development of one acre or more in area, a minimum 10 percent of total contiguous area under single ownership or under the control of a property owner's association shall be provided as public or private open space including but not limited to, parks, greenways, plazas, and on-site amenities such as recreation areas.

iv. Pedestrian paths shall be provided within the development between principal uses and destinations including but not limited to, parking, adjoining streets, mailboxes, waste disposal, adjoining sidewalks or greenways, the riverwalk, and on-site amenities such as recreation areas.

b. Downtown core

i. The downtown core is the historic urban center of the CBD with a mix of dense development that engages the community at the pedestrian level. Alluring shopfronts interspersed with focal community gathering spaces align each block in this area in order to create a vibrant

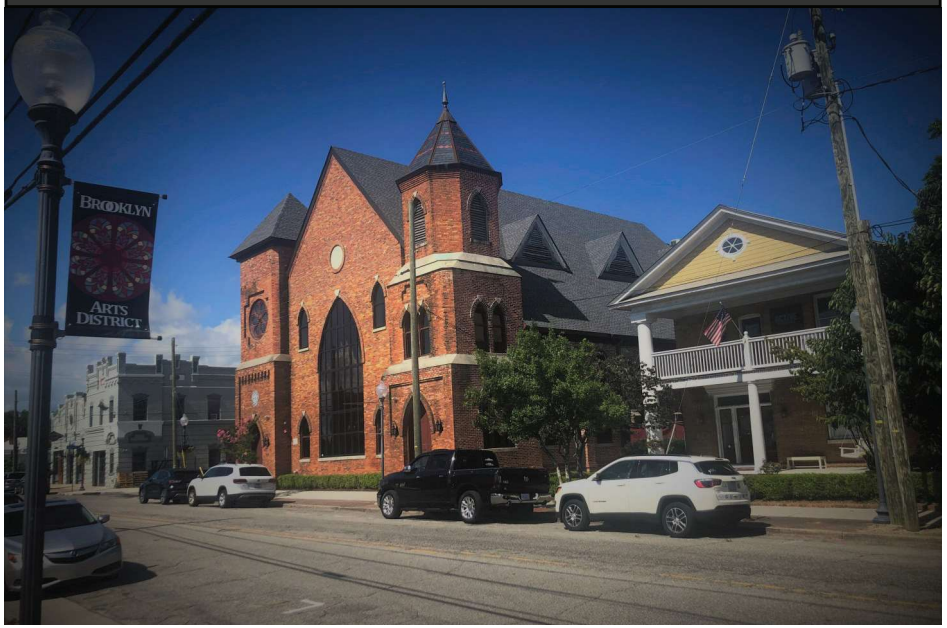
Figure 18-44.30: North of Red Cross Street example



Figure 18-44.31: Downtown core example



Figure 18-44.32: North 4th Street example



and vivacious urban environment (see Figure 18-44.31: Downtown core example).

ii. Residential uses shall be prohibited on the ground floor fronting any street right-of-way and the riverwalk.

c. North 4th Street

i. Moderately-scaled development with diverse architectural styles make up the area along North 4th Street. This pattern provides a unique and appropriate transition to the adjacent residential development bordering the CBD (see Figure 18-44.32: North 4th Street example).

ii. Residential compatibility

When nonresidential uses are proposed on lots adjacent to a single-dwelling zoned lot, the following standards shall apply:

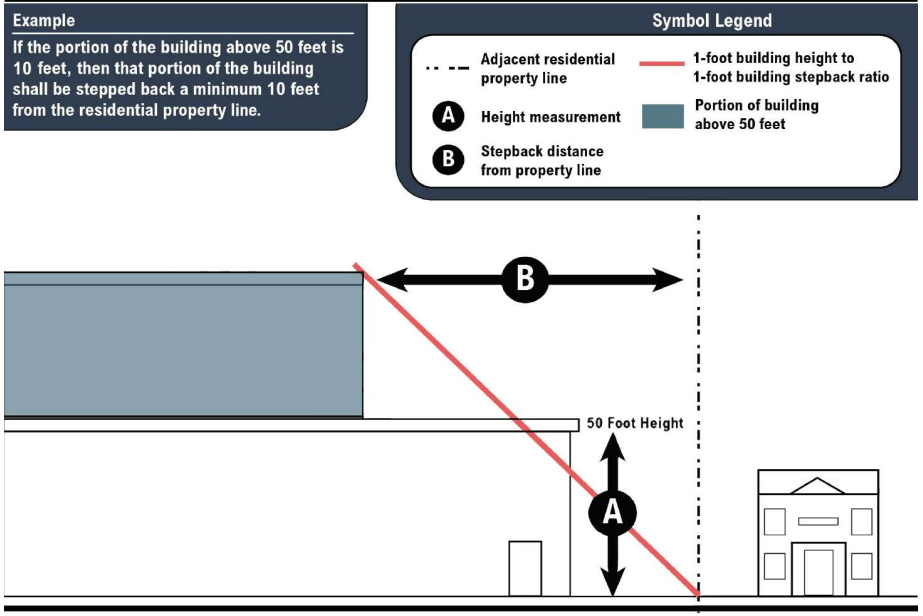
a. New buildings or developments that increase the building height above 50 feet shall provide a development transition using a graduated building height and mass by stepping back the portion of the building above 50 feet (see Figure 18-33: Residential compatibility).

b. The portion of the building above 50 feet shall be stepped back from residentially-zoned lot lines at a ratio of one foot for every additional foot of building height.

iii. Historic district overlay

a. The historic district overlay (HDO) is adjacent to the traditional urban neighborhood development patterns of historic residences. The overlay is developed primarily with smaller scale development that serves as a transition from the downtown core to the historic residences just outside of the CBD.

Figure 18-44.33: Residential compatibility



b. Historic Preservation Commission review

Within the HDO, building design is subject to historic preservation commission review. Approvals for projects within the HDO may necessitate the meeting of a more restrictive standard than required by this section. The HPC shall not have the authority to waive the requirements of this section.

(Ord. No. O-2021-75, §1, 11-3-2021; Ord. No. O-2022-88, § 2(Att. A), 11-1-2022; Ord. No. O-2023-75, §§1--3, 11-8-2023)

Sections 18-45 - 18-55. Reserved.

ARTICLE 2. DIVISION 4.

HISTORIC DISTRICTS

Section 18-56: Purpose statements

A. HDR, Historic district - residential

Historic district – residential is intended to protect, preserve, and maintain Wilmington's historic residential architecture from the high style to the vernacular. Preservation of the public and private historic fabric of the district, and the cultural, social, economic, and architectural development it represents is a priority for the community. This district serves as a mechanism to promote the integrity of the residential character of the district by ensuring existing and future uses are compatible with one another and that historic character is retained.

B. HDMU, Historic district - mixed use

Historic district – mixed use is intended to protect and keep the heritage of the city by preserving the district, and individual buildings within the district. This district allows blocks of early existing office and business uses outside of the central business district to thrive. The HDMU allows infill development consistent with historic fabric and supports a mix of uses that are compatible in scale to stabilize and enhance property values throughout the district.

C. HD, Historic district

The historic district, also known as the Theater Historic District, is intended to promote the educational and cultural resources of the city, and to keep Wilmington's architectural heritage by preserving the district as a whole, as well as individual buildings within the district that embody the important elements of the city's social, economic, political, cultural, ecclesiastical, and architectural history.

The goal is to sustain the continued viability of historic neighborhoods, allow infill development consistent with historic fabric, and support a mix of uses that are compatible in scale to stabilize and enhance property values throughout the district.

Section 18-57: Historic districts use table

The following uses are permitted as principal uses in the mixed-use districts if required applicable conditions and approvals are met. Uses not listed in this table are prohibited in these districts, pursuant to Section 18-19: Uses. For permitted accessory uses and temporary uses, refer to article 3 of this chapter.

Table 18-57: Use table for historic districts

Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited

Principal use	Additional standards	HDR	HDMU	HD
Civic and institutional				
Assembly	Section 18-126			
Civic club or lodge, private			S	S
Community center				
Building footprint up to 5,000 sq. ft.		S	S	S
With outdoor facilities		S	S	S
Entertainment and trade			C	S
Religious		C	C	C
Community garden	Section 18-134	C	C	C
Daycare, adult or child	Section 18-135		S	S
Domestic violence shelter	Section 18-139	C	C	C
Dormitory, fraternity, or sorority house	Section 18-140		S	
Government facility excluding of rights-of-way	Section 18-148		C	C
Library	Section 18-155		C	S
Public parks, playgrounds, boat ramps		P	P	P

Table 18-57: Use table for historic districts				
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited				
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**
Civic and institutional				
School	Section 18-167			
College or university			C	S
Primary and secondary		C	C	C
Trade, business, technical, and vocational			C	C
Commercial				
Alternative financial services	Section 18-123		S	S
Art gallery			P	P
Artisan food and beverage production	Section 18-125		C	C
Banks and financial institutions			P	P
Commercial recreation, indoor				
General, large: building footprint greater than 2,000 sq. ft.			P	P
General, small: building footprint up to and including 2,000 sq. ft.			P	P
Crematory			P	P
Equipment repair	Section 18-143		C	C
Funeral home and mortuary			P	P
General business services	Section 18-146		C	C

Table 18-57: Use table for historic districts				
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited				
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**
Commercial				
General personal services			P	P
General retail				
Small: building footprint up to 5,000 sq. ft.			P	
Home maintenance service	Section 18-152		C	C
Lodging	Section 18-157			
Bed and breakfast		C	C	C
Homestay		C	C	C
Whole house		C	C	C
Offices			P	P
Restaurant	Section 18-166		C	C
Spa and health club	Section 18-171		S	S
Studio, performing art, fine art, dance, martial arts			P	P
Industrial				
Utility and public facility	Section 18-173			
Major			S	S
Minor		C	C	C

Table 18-57: Use table for historic districts				
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited				
Principal use	**Additional standards**	**HDR**	**HDMU**	**HD**
Industrial				
Wireless communication facility	Section 18-183	C	C	C
Residential				
Assisted living residence	Section 18-127		S	S
Dwelling unit	Section 18-141			
Attached: duplex		P	P	P
Attached: multiple		S	C	C
Attached: townhouse		S	C	C
Attached: triplex, quadplex		C	C	C
Detached: single		P	P	P
Family care home	Section 18-144	C	C	C
Group home residential	Section 18-149	S	S	S
Group home supportive	Section 18-150			
Large			S	S
Medium		C	C	C
Small		C	C	C

Section 18-58: Dimensional standards

Development and new lots in the historic districts shall conform to the following standards. Relevant district-specific standards shall also apply (see figures 18-58.1: Historic districts dimensions and 18-58.2: Historic districts example).

Table 18-58: Historic districts dimensional standards

	HDR	HDMU	HD
Lot requirements			
Minimum lot area (square feet)			
Dwelling, detached	2,000	2,000	2,000
Dwelling, duplex (total lot area)	4,000	4,000	4,000
Dwelling, triplex, quadraplex (per unit)	2,000	2,000	2,000
Dwelling, townhouse (per unit)	2,000	3,000	3,000
Multiple	10,000	10,000	10,000
Minimum lot width (feet)	33	33	33
Minimum setbacks (feet)			
Front	Established by the Historic Preservation Commission		
Side street			
Side interior			
Rear			
Building size			
Maximum height (feet)	35	55	55

Figure 18-58.1: Historic district dimensions

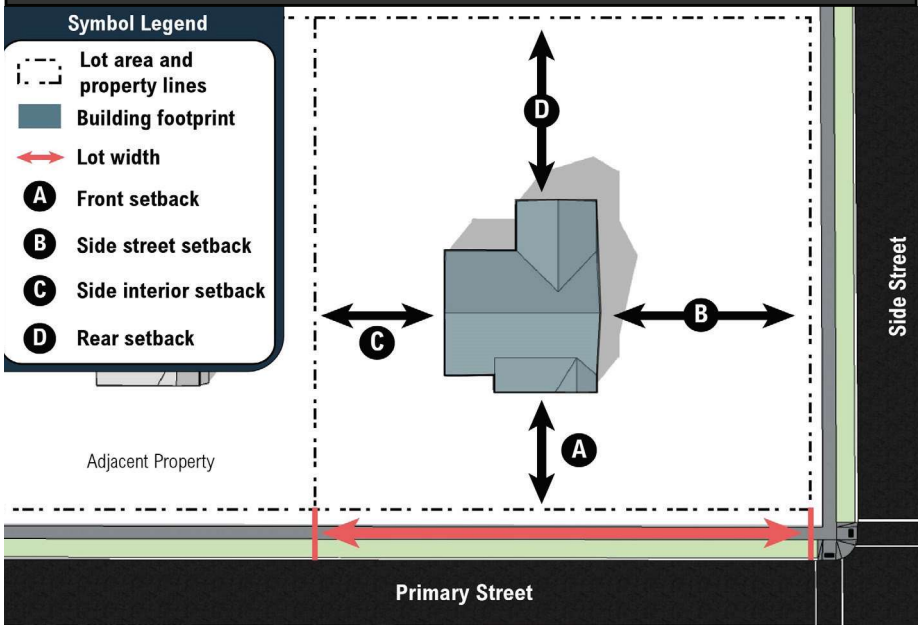


Figure 18-58.2: Historic district example



Section 18-59: District-specific standards

The following standards apply to all historic district development.

A. Certificate of appropriateness

All development and exterior changes are subject to review as specified in Section 18-597: Historic preservation.

B. Residential uses and conversions

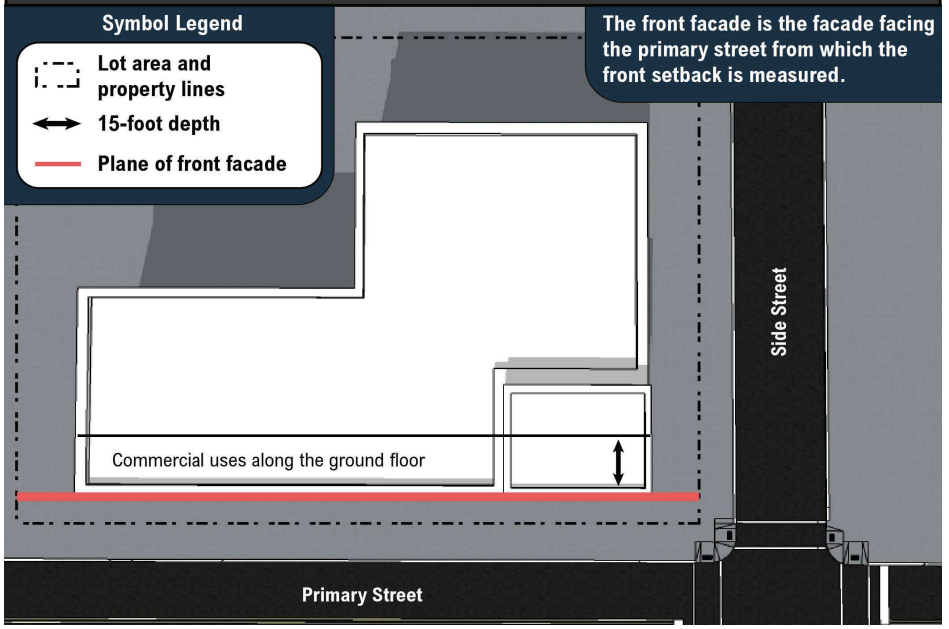
Conversion of residential buildings to higher density shall meet the density standards for new construction.

C. Building design

1. The historic preservation commission may require a building height less than the established maximum height but may not allow a building to exceed the maximum building height.

2. Any structured parking in the HDMU and HD districts shall be lined with commercial uses for a minimum depth of 15 feet from the plane of the front facade on the ground floor (see Figure 18-59: Structured parking in the HDMU and HD districts).

Figure 18-59: Structured parking in the HDMU and HD districts



Sections 18-60 - 18-70: Reserved

ARTICLE 2. DIVISION 5.

COMMERCIAL DISTRICTS

Section 18-71: Purpose statements

A. CB, Community business

This district is intended to integrate appropriately scaled office, retail, and personal service uses with adjacent or surrounding residential neighborhoods. The purpose of the CB district is to create convenient, walkable nodes that serve the day-to-day needs of nearby residents. Ideally, these nodes should be located at street intersections and may be created on infill sites or through redevelopment. To ensure that the allowed uses are compatible with the surroundings and consistent with this intent, building size limits may be imposed, along with other spatial standards, to regulate the scale of the development and minimize additional vehicular traffic.

B. RB, Regional business

This district is intended to accommodate the range of retail and service uses serving the broad needs of the community and surrounding region. Larger-scaled retailers, auto-related businesses, and similar uses, not generally appropriate for or out of character with the CB district, are permitted. While the RB district should be located primarily along arterial roadways, care should be taken to ensure compatibility with adjacent uses, allow for pedestrian movement, and minimize conflicts with traffic along abutting streets. Generally, these areas are already developed and are likely to undergo change only through business turnover, infill, or redevelopment.

C. CS, Commercial services

This district is intended to accommodate intense business uses that frequently require outdoor storage, may involve machinery, and have minimal customer traffic. Uses include building contractors, repair services, wholesaling, and some light industry. The CS district is intended to be located near industrial areas and may serve as a transitional district between industrial and commercial uses.

D. O&I, Office and institutional

This district is intended to accommodate professional and medical offices, institutions of various sizes, places of assembly, and complementary uses without the added traffic and development intensity associated with broad commercial and retail activities. The O&I district is well suited to supporting higher education and health care centers and office uses, along with complementary uses such as small-scale retail, services, and restaurants. When appropriate conditions are met, residential uses, in combination with compatible office and institutional uses, are appropriate within this district to support a desirable live/work environment.

Section 18-72: Commercial use table

The uses prescribed in Table 18-72 are permitted as principal uses in commercial districts if required applicable conditions and approvals are met. Uses not listed in this table are prohibited in these districts, pursuant to Section 18-19: Uses. For permitted accessory and temporary uses, refer to article 3 of this chapter.

Table 18-72: Use table for commercial districts

Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited

Principal use	Additional standards	CB	RB	CS	O&I
Civic and institutional					
Assembly					
Civic club or lodge, private		P	P	P	P
Community center		P	P	P	P
Entertainment and trade		P	P	P	P
Religious		P	P	P	P
Chemical dependency treatment facility		P			P
Daycare, adult or child	Section 18-138	C	C	C	C
Domestic violence shelter		P	P	P	P
Dormitory, fraternity, or sorority house	Section 18-140				C
Government facilities excluding of rights-of-way		P	P	P	P
Hospital	Section 18-153				C
Library		P	P	P	P
Nursing home		P			P
Public parks, playgrounds, boat ramps		P	P	P	P
Rehabilitation facility		P			P

Table 18-72: Use table for commercial districts					
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited					
Principal use	**Additional standards**	**CB**	**RB**	**CS**	**O&I**
Civic and institutional					
School	Section 18-167				
College or university					P
Primary and secondary		C	C		C
Trade, business, technical, and vocational			P	P	P
Commercial					
Alternative financial services	Section 18-123		C	C	
Animal hospital, veterinary clinic	Section 18-124				
No outdoor pens or runs		P	P	P	P
With outdoor pens or runs		C	C	C	C
Art gallery		P	P	P	P
Artisan food and beverage production	Section 18-125	C	C	C	
Auction house	Section 18-128		C	C	
Banks and financial institutions		P	P	P	P
Commercial parking	Section 18-132	C	C	C	C

Table 18-72: Use table for commercial districts					
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited					
Principal use	**Additional standards**	**CB**	**RB**	**CS**	**O&I**
Commercial					
Commercial recreation, indoor					
Drop-in childcare		P	P	P	P
Electronic gaming establishment	Section 18-142	C	C	C	
General, large: building footprint greater than 2,000 sq. ft.			P	P	
General, small: building footprint up to and including 2,000 sq. ft.		P	P	P	
Commercial recreation, outdoor	Section 18-133				
General, large: building footprint greater than 5,000 sq. ft.		P	P		
General, small: building footprint up to 5,000 sq. ft.		P	P		
Golf course			C		
Golf driving range			C	C	
Zoo			S	S	
Crematory		P	P	P	P
Equipment repair		P	P	P	
Exterminating services			P	P	
Farmers' market	Section 18-145	C	C	C	

Table 18-72: Use table for commercial districts					
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited					
Principal use	**Additional standards**	**CB**	**RB**	**CS**	**O&I**
Commercial					
Food catering services		P	P	P	
Funeral home and mortuary		P	P	P	P
General business services	Section 18-146	C	C	C	C
General personal services		P	P	P	P
General retail	Section 18-147				
Large: building footprint 40,001 sq. ft. or larger		C	C	C	
Medium: building footprint 5,001 - 40,000 sq. ft.		P	P	P	
Small: building footprint up to 5,000 sq. ft.		P	P	P	
Heavy equipment sales, rentals, services			P	P	
Home maintenance services		P	P	P	
Kennel, commercial	Section 18-154	C	C	C	
Laboratory			P	P	P
Laundry service		P	P	P	

Table 18-72: Use table for commercial districts					
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited					
Principal use	**Additional standards**	**CB**	**RB**	**CS**	**O&I**
Commercial					
Lodging	Section 18-157				
Homestay		C	C	C	C
Hotel/motel		P	P	P	P
Whole house		C	C	C	C
Marina		P	P	P	
Movie theater			P	P	
Nightclub	Section 18-161	C	P	P	
Offices		P	P	P	P
Recreation facility, private		P	P	P	P
Restaurant		P	P	P	P
Spas and health clubs		P	P	P	P
Studio, performing art, fine art, dance, martial arts		P	P	P	P
Truck stop	Section 18-172		C	C	
Urban farm	Section 18-174	C	C	C	
Vehicle renting	Section 18-175		C	P	

Table 18-72: Use table for commercial districts					
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited					
Principal use	**Additional standards**	**CB**	**RB**	**CS**	**O&I**
Commercial					
Vehicle repair and service	Section 18-176				
Major			C	C	
Minor		C	C	C	
Vehicle sales	Section 18-177		C	C	
Vehicle wash	Section 18-179		C	C	
Water transportation		P	P	P	P
Industrial					
Brewery or distillery	Section 18-129		C	C	
Micro		C	C	P	
Small/regional			C	C	
Manufacturing				C	
Building materials or product sales			P	P	
Bus and taxi services			P	P	
Contractor storage yard	Section 18-136		C	C	
Laundry services, industrial				P	
Motion picture production and distribution	Section 18-159			C	
Moving company	Section 18-160		C	P	

Table 18-72: Use table for commercial districts					
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited					
Principal use	**Additional standards**	**CB**	**RB**	**CS**	**O&I**
Industrial					
Nursery and greenhouse	Section 18-162				
Including retail sales		C	P	P	
Not including retail sales				P	
Outdoor storage	Section 18-163			C	
Railroad facilities	Section 18-164				
Freight				C	
Passenger		C	C	C	C
Self-storage facility	Section 18-168				
Indoor				C	
Outdoor				C	
Utility and public facility	Section 18-173				
Major			C	P	C
Minor		P	P	P	C
Warehouse and distribution center	Section 18-180			C	
Wholesale business	Section 18-181			C	
Wind energy conversion system	Section 18-182			S	

Table 18-72: Use table for commercial districts					
Key: P = Permitted, C = Permitted with Conditions, S = Special Use Permit Required, Blank = Prohibited					
Principal use	**Additional standards**	**CB**	**RB**	**CS**	**O&I**
Industrial					
Wireless telecommunication facility	Section 18-183	C	C	C	C
Residential					
Assisted living residence	Section 18-127				C
Continuum of care community	Section 18-135	C			C
Dwelling unit					
Commercial district mixed use	Section 18-131	C	C		C
Family care home	Section 18-144				C
Group home residential	Section 18-149	S	S	S	S
Group home supportive	Section 18-150				
Large		C			C
Medium		C			C
Small		C			C

(Ord. No. O-2023-41, §1, 6-6-2023)

Section 18-73: Dimensional standards

A. Dimensional standards

Development and new lots in the commercial districts shall conform to the standards prescribed in Table 18-73: Relevant district-specific standards shall also apply (see figures 18-73.1: Commercial districts dimensions and 18-73.2: Commercial districts example). For lots subject to frontage standards per article 5, division 6 of this chapter, the frontage standards shall apply.

Table 18-73: Commercial districts dimensional standards

	CB	RB	CS	O&I
Lot requirements				
Minimum lot area (square feet)	None	22,000	15,000	15,000
Minimum lot width (feet)	50	80	80	80
Minimum setbacks (feet)				
Front	10	20	20	20
Side street	10	20	20	20
Side interior	0	0	0	0
Side interior, residential adjacent (zoning only)	25	50	50	25
Rear	5	15	15	20
Rear, residential adjacent (zoning only)	25	25	25	25
Building size				
By-right height (feet)	45	45	35	45
Optional height increase (feet)		96		96
Maximum building footprint (percent of total lot area)	30	40		40
Residential requirements	See Section 18-131: Commercial districts - mixed use			

Figure 18-73.1: Commercial districts dimensions

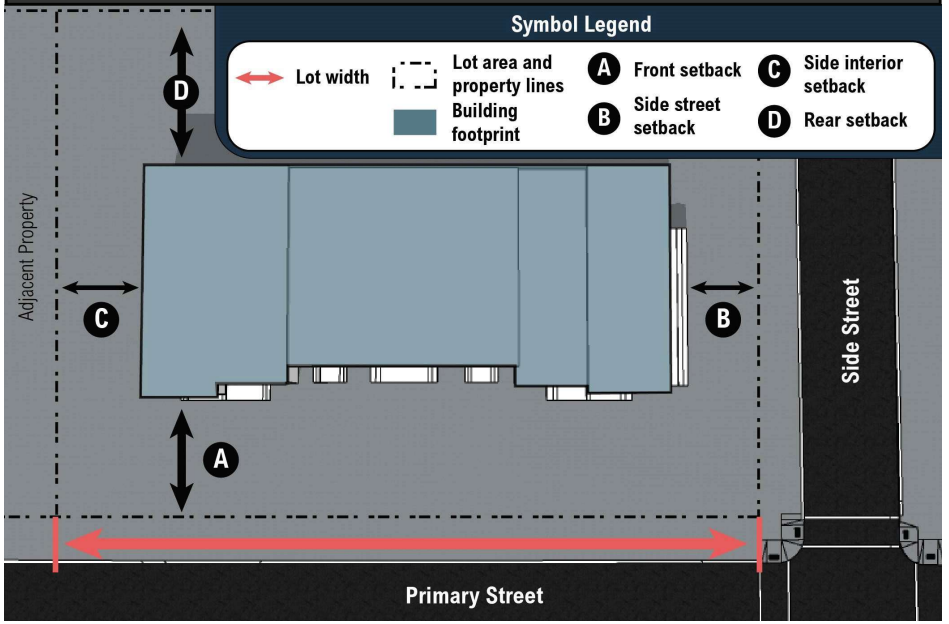
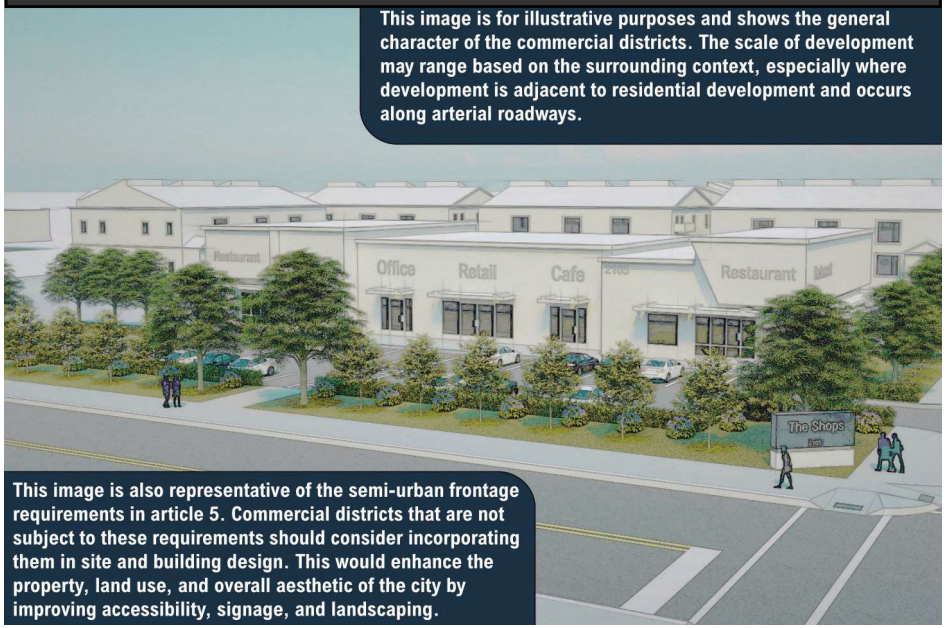


Figure 18-73.2: Commercial districts example



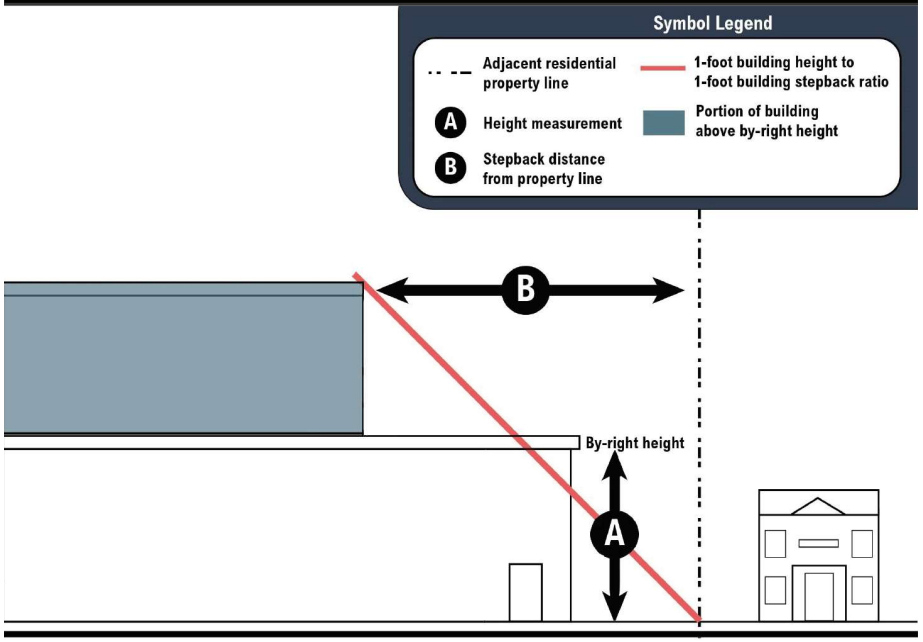
B. Optional building height increase

In the RB and O&I districts, building height may be increased above the by-right height. New buildings or developments that increase the by-right height shall provide a development transition using graduated building height and mass in the form of building step-backs.

1. That portion of the building above the by-right height, shall be stepped back from front and side lot lines at a ratio of one foot for every foot of building height. For example, for a 60-foot-tall building, the portion of the building from 45.1 feet to 60 feet in height shall have a 60-foot step back from lot lines (see Figure 18-73.3 Building step backs).

2. When adjacent to single-dwelling residential zoning, step backs shall also be applied to any shared lot lines.

Figure 18-73.3: Building step-backs



C. Residential compatibility standards

When nonresidential uses are proposed on lots adjacent to a lot zoned for single-dwelling residential use, the following standards shall apply:

1. The following uses or features shall be prohibited within 200 feet of single-dwelling residential zoning:

   a. Outdoor amplified sound, including public address/ loudspeaker systems; and

   b. Outdoor storage.

2. Parking

   Off-street parking shall be limited to one or more of the following locations. The locations are listed in priority order and shall be applied in the highest location from this list. For lots subject to frontage standards per article 5, the frontage standards shall apply.

   a. Adjacent to off-street parking lots serving nonresidential uses on abutting lots.

   b. Adjacent to lot lines shared with nonresidential zoning and development.

   c. Adjacent to lot lines shared with mixed-use development.

   d. Behind the building.

   e. In front of the building.

   f. Adjacent to lot lines shared with residential uses.

   g. Any parking designated for trucks, recreational vehicles, and other large vehicles shall not be located within 75 feet of a lot line shared with a single-dwelling zoned lot, nor within 25 feet of any street.

3. Relationship to surrounding uses

    a. Multi-building developments shall be configured to place the tallest and largest buildings within the core of the site and provide a gradual decrease in building height and mass towards adjacent residential uses.

    b. Pedestrian and bicycle connections to adjacent single dwelling residential uses shall be provided to facilitate non-motorized transportation between residential and nonresidential uses.

    c. Nonresidential buildings exceeding 35 feet in height shall be broken up into modules or wings with the smaller or shorter portions of the building located adjacent to uses and the taller or larger portions away from single dwelling zoning.

4. Facade configuration

    Service functions (e.g., refuse collection, incidental storage, etc.) shall be integrated into the architecture of the building unless an alternative location places these functions farther from adjacent single-dwelling zoning.

5. Operation

    a. Nonresidential uses with outdoor components (e.g., outdoor dining, performance areas) shall not be located within 200 feet of a residential zoning district, as measured from the component to the residentially-zoned lot line.

    b. Loading or unloading facilities shall not be located within 200 feet of any residential zoning district.

(Ord. No. O-2021-75, §2, 11-3-2021; Ord. No. O-2022-41, §7, 6-7-2022)

Section 18-74: District-specific standards

In the office and institutional district, the following standards shall apply:

A. Exterior building materials for new construction shall be limited to the following materials, which may be used in any combination:

    1. Wood;

    2. Stucco, including synthetic stucco material;

    3. Brick;

    4. Shingles;

    5. Vinyl or fiber cement board designed to resemble wooden lap siding or shingles;

    6. Glass and glass framing materials;

    7. Architectural concrete and concrete products;

    8. Metal, not to exceed 49% of the area of the front facade;

    9. Natural or manufactured stone products; and

    10. Ceramic products.

B. Roofing materials for new construction shall be limited to the following:

    1. Tile;

    2. Shingle;

    3. Metal; or

    4. A combination of the above-listed materials.

    5. In the case of a flat roof, a membrane material may be used.

(Ord. No. O-2022-41, §8, 6-7-2022)

Sections 18-75 - 18-85: Reserved.

ARTICLE 2. DIVISION 6.

INDUSTRIAL DISTRICTS

Section 18-86: Purpose statements

A. LI, Light industry

This district is intended to accommodate light manufacturing, distribution, research, and appropriate support service. These types of light industrial operations range in size and intensity, with lower intensity operations compatible with other nonresidential uses.

B. IND, General industry

This district is intended to accommodate larger or more intensive manufacturing and distribution facilities and related support services. General industry sites typically have ready access to necessary utilities and transportation infrastructure. Characteristics of the uses in this district may include outdoor storage areas, truck traffic, production of goods from raw materials, multiple worker shifts, and low worker-to-land ratios.

Section 18-87: Industrial use table

The uses prescribed in Table 18-87 are permitted as principal uses in industrial districts if required applicable conditions and approvals are met. Uses not listed in this table are prohibited in these districts, pursuant to Section 18-19: Uses. For permitted accessory and temporary uses, refer to article 3 of this chapter.

Table 18-87: Use table for industrial districts

Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited

Principal use	Additional standards	LI	IND
Civic and Institutional			
Assembly	Section 18-126		
Religious		C	
Correctional facility	Section 18-137		C
Daycare, adult or child	Section 18-138	C	
Government facilities excluding of rights-of-way	Section 18-148	P	P
School	Section 18-167		
Trade, business, technical, and vocational		P	P
Commercial			
Animal hospital, veterinary clinic			
No outdoor pens or runs		P	
With outdoor pens or runs	Section 18-124	C	
Artisan food and beverage production	Section 18-125	C	
Auction house		P	
Commercial parking	Section 18-132	C	C

Table 18-87: Use table for industrial districts			
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited			
Principal use	**Additional standards**	**LI**	**IND**
Commercial			
Commercial recreation, indoor			
Drop-in childcare		P	
Electronic gaming establishment		P	
General, large: building footprint greater than 2,001 sq. ft.		P	
General, small: building footprint up to 2,000 sq. ft.		P	
Commercial recreation, outdoor			
General, large: building footprint greater than 5,001 sq. ft.		P	
General, small: building footprint up to 5,000 sq. ft.		P	
Crematory		P	P
Equipment repair	Section 18-143	C	P
Exterminating services		P	P
Food catering services		P	
General business services		P	P
General retail			
Small: building footprint up to 5,000 sq. ft.		P	

Table 18-87: Use table for industrial districts			
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited			
Principal use	**Additional standards**	**LI**	**IND**
Commercial			
Heavy equipment sales, rentals, services		P	P
Home maintenance services		P	
Kennel, commercial		P	
Laboratory		P	P
Marina		P	P
Nightclub	Section 18-161	C	
Offices		P	P
Restaurant	Section 18-166	C	
Sexually-oriented business	Section 18-169	C	C
Truck stop	Section 18-172	C	C
Urban farm	Section 18-174	C	
Vehicle renting	Section 18-175	C	
Vehicle repair and service	Section 18-176		
Minor		P	
Vehicle sales	Section 18-177	C	

Table 18-87: Use table for industrial districts			
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited			
Principal use	**Additional standards**	**LI**	**IND**
Commercial			
Vehicle towing	Section 18-178	C	C
Vehicle wash	Section 18-179	C	
Water transportation		P	P
Industrial			
Airport	Section 18-122	C	C
Boat building and repair		P	P
Brewery or distillery			
Micro		P	P
Small/regional		P	P
Manufacturing		P	P
Building materials or product sales		P	P
Bus and taxi service		P	P
Contractor storage yard	Section 18-136	C	P
Distribution facilities		P	P
Dry cleaning		P	P
Express and parcel delivery services		P	P
Freight and intermodal terminals		P	P
Fuel storage facility			P

Table 18-87: Use table for industrial districts			
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited			
Principal use	**Additional standards**	**LI**	**IND**
Industrial			
Heavy manufacturing, general			P
Heliports/helipads	Section 18-151	C	C
Laundry services, industrial		P	P
Light manufacturing, general		P	P
Manufactured homes sales		P	P
Metal coating, engraving, and allied services		P	P
Mills, sawing or planing		P	P
Motion picture production and distribution		P	P
Moving companies		P	P
Nursing and greenhouses			
Including retail sales		P	
Not including retail sales		P	P
Outdoor storage	Section 18-163	C	P
Petroleum and natural gas related industries			P

Table 18-87: Use table for industrial districts			
Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited			
Principal use	**Additional standards**	**LI**	**IND**
Industrial			
Railroad facilities			
Freight		P	P
Passenger		P	P
Self-storage facility			
Indoor		C	C
Outdoor		C	C
Shipping container storage and sales		P	P
Solar farm	Section 18-170	C	C
Utility and public facility			
Major		P	P
Minor		P	P
Warehouse and distribution center		P	P
Welding repair		P	P
Wholesale business		P	P
Wind energy conversion system	Section 18-182	S	S
Wireless telecommunication facility	Section 18-183	C	C

(Ord. No. O-2023-41, §1, 6-6-2023)

Section 18-88: Dimensional standards

Development and new lots in the industrial districts shall conform to the standards prescribed in Table 18-58: Industrial districts dimensional standards. Relevant district-specific standards shall also apply (see figures 18-88.1 Industrial districts dimensions and 18-88.2 Industrial districts example).

Table 18-58: Industrial districts dimensional standards

	LI	IND
Lot requirements		
Minimum lot area	20,000 sq. ft.	1 acre
Minimum lot width (feet)	80	100
Minimum setbacks (feet)		
Front	35	35
Side street	35	35
Side interior	10	10
Side interior, residential adjacent	35	50
Rear	20	20
Rear, residential adjacent	35	50
Building size		
By-right height (feet)	45	45
Optional maximum height increase (feet)	96	96

Figure 18-88.1: Industrial districts dimensions

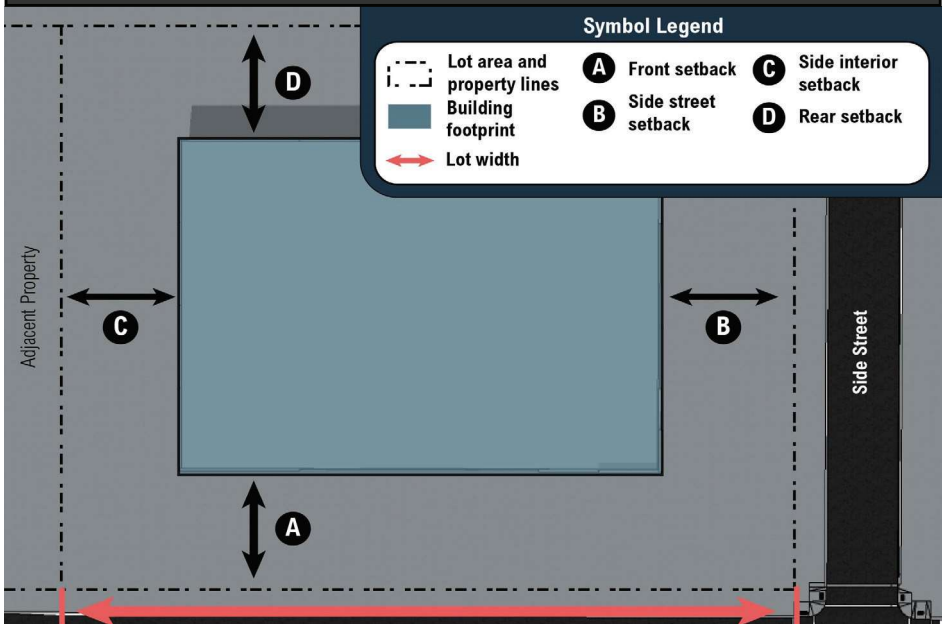
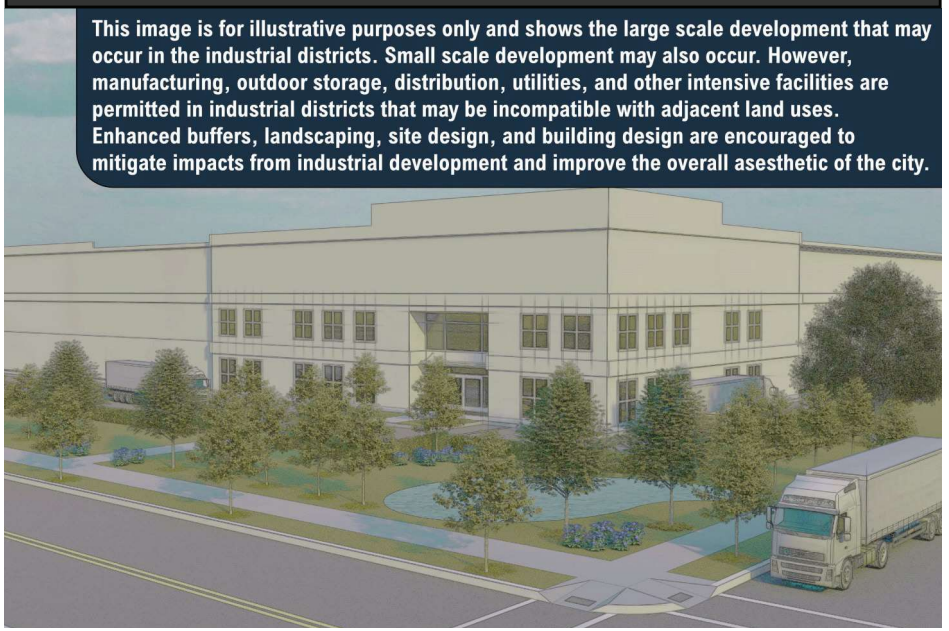


Figure 18-88.2: Industrial districts example

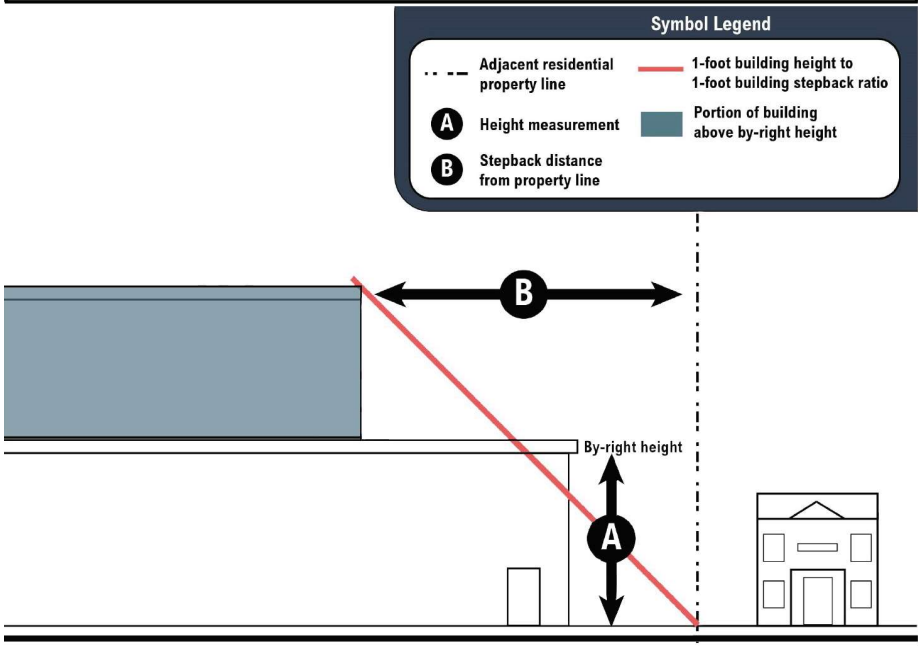


A. Optional building height increase

In the LI and IND districts, building height may be increased above the by-right height. New buildings or developments that increase the by-right height shall provide a development transition using graduated building height and mass in the form of building step-backs.

1. That portion of the building above the by-right height, shall be stepped back from front and side lot lines at a ratio of one foot for every foot of building height. For example, for a 60-foot-tall building, the portion of the building from 45.1 feet to 60 feet in height shall have a 60-foot step back from lot lines (see Figure 18-88.3 Building step backs).
2. When adjacent to single-dwelling residential zoning, step backs shall also be applied to any shared lot lines.

Figure 18-73.2: Commercial districts example



B. Residential compatibility standards

When LI and IND uses are proposed on lots adjacent residential zoning, the following standards shall apply:

1. Use limitations
   a. The following uses or features shall be prohibited within 200 feet of single-dwelling residential zoning:
      i. Outdoor amplified sound, including public address/ loudspeaker systems;
      ii. Outdoor storage; and
      iii. Facilities for the delivery of inventory or merchandise via tractor trailers.
   b. Off-street parking shall not be located within 50 feet of a lot line shared with residential zoning.
2. Relationship to surrounding uses
   a. Multi-building developments shall be configured to place the tallest and largest buildings within the core of the site and provide a gradual decrease in building height and mass towards adjacent residential uses.
   b. Horizontally-integrated mixed-use developments shall locate nonresidential uses away from lots zoned for single-dwelling.
   c. Pedestrian and bicycle connections to adjacent residential uses shall be provided in order to facilitate non-motorized transportation between residential and nonresidential uses.
   d. Nonresidential buildings exceeding 35 feet in height shall be broken up into modules or wings with the smaller or shorter portions of the building located adjacent to single-dwelling uses and the taller or larger portions away from single dwelling zoning.

3. Facade configuration

   Service functions (e.g., refuse collection, incidental storage, etc.) shall be integrated into the architecture of the building unless an alternative location places these functions farther from adjacent residential zoning.

(Ord. No. O-2021-75, §3, 11-3-2021; Ord. No. O-2022-41, §9, 6-7-2022)

Secs. 18-89-18-99: Reserved.

ARTICLE 2. DIVISION 7.

SPECIAL, OVERLAY, AND LEGACY DISTRICTS

Section 18-100: CEM, Cemetery district

A. Purpose

This district is intended to regulate the location of cemetery activities within the city and to ensure the compatibility of the cemetery with the surrounding land uses, thereby protecting the health, safety, and general welfare of the city residents.

B. Uses

The following uses are permitted as principal uses in the cemetery district if the required applicable conditions and approvals can be met. Uses not listed in this table are prohibited in this district, pursuant to Section 18-19: Uses. For permitted accessory and temporary uses, refer to article 3 of this chapter.

C. Dimensional standards

Development and new lots in the cemetery district shall conform to the dimensional standards in Table 18-100.2: Cemetery district dimensional standards.

Table 18-100.1: Use table for cemetery districts

Key: P = Permitted, C = Permitted with conditions, S = Special use permit required, Blank = Prohibited

	CEM
Principal use	
Cemetery	P
Crematory	P
Funeral home and mortuary	P

Table 18-100.2: Cemetery districts dimensional standards

	CEM
Lot requirements	
Minimum lot area (acres)	2 acres
Minimum lot width (feet)	100
Minimum setbacks (feet)	
Front	30
Side street	30
Side interior	10
Rear	25
Building size	
Maximum height (feet)	35

Section 18-101: HDO, Historic district overlay

A. Purpose

The purpose of the historic district overlay is to protect and preserve areas which, because of their architectural significance, historic importance, and overall aesthetic qualities, are important elements of the community's character and enhance the overall heritage of the city, county, and state. A historic district overlay may be established to safeguard the qualities of an area and individual property to promote important elements of the community's social, economic, cultural, and architectural traditions; promote the conservation of the city's neighborhood resources for the continued use, education, pleasure, and enrichment of the residents of the city, county, and state; and stabilize property values within the area as a whole, and thereby contribute to the improvement of the general welfare of the city of Wilmington. In a historic district overlay, the underlying zoning district regulates use while an added level of design review is exercised to safeguard the historic, architectural, and cultural importance of the properties and buildings located in the overlay.

B. Provisions

A historic district overlay overlaps other zoning districts established by this chapter. The extent and boundaries of an overlay shall be indicated on the official zoning map for the city of Wilmington. While a historic district overlay may overlap any zoning district, the existing land use provisions of the underlying district shall prevail in the development of any property within such district. Before any construction, alteration, demolition, relocation, or any exterior change commences on a property in the historic district overlay, a certificate of appropriateness shall be issued by the historic preservation commission.

C. Design exceptions

Only alterations, restoration, reconstruction, new construction, relocation, or demolition visible from public rights-of-way, except that which is visible only from a public alley, shall be required to obtain a certificate of appropriateness. Any principal building used as a residence shall not require a certificate of appropriateness for paint color.

Section 18-102: Legacy districts

Upon the effective date of this ordinance, the following districts shall become legacy districts. Any property zoned as legacy district, zoned as such prior to the adoption of this ordinance, shall conform to the standards of the land development code in effect as of November 30, 2021. Any property zoned as a legacy district shall be shown on the official zoning map with an (L) following the zoning district name (e.g., R-20(L), MF-H(L)). New legacy districts shall not be added to the zoning map.

Table 18-102: Legacy districts

Legacy district	Comparable alternative district
MX, Mixed-use district	Commercial district with mixed-use option
UMX, Urban mixed-use district	Commercial district with mixed-use option
MF-MH, Multiple family residential, medium-high density	MF-17
MF-H, Multiple family residential, high density	MF-17
R-20 Residential district	R-15

Section 18-103 - 18-113: Reserved.

Appendix M

City of Wilmington Code of Ordinances
Article 8. Landscaping and Tree Preservation

ARTICLE 8. - LANDSCAPING AND TREE PRESERVATION

DIVISION I. - GENERAL

Sec. 18-446. - Purpose.

The landscaping and buffering standards of this section are intended to accomplish the following purposes:

(a) Maintain visual character of the community;

(b) Screen objectionable views within and between uses;

(c) Define functional exterior spaces;

(d) Reduce glare into and from the site;

(e) Reduce dust and other pollutants suspended in the air;

(f) Control noise and provide acoustical modification into and from the site;

(g) Influence wind patterns and their effects upon proposed uses;

(h) Contain odors and minimize their passage into and from the site;

(i) Control the direction and velocity of surface water runoff;

(j) Maintain the integrity of the natural heritage and provide wildlife habitat;

(k) Maintain indigenous species and species diversity;

(l) Minimize soil erosions;

(m) Moderate interior and exterior temperatures by controlling solar radiation, shading buildings and paved surfaces;

(n) Maintain the aesthetic quality of property that enhances its value;

(o) Transpire water;

(p) Reduce hazards and minimize liability;

(q) Encourage appropriate and professional arboricultural and landscaping practices; and

(r) Increase the economic return for developers and property owners by preserving mature trees to the greatest extent practicable.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 23, 12-4-12)

Sec. 18-447. - Applicability.

In order to meet the above functions, landscaping shall be required for the purposes of:

(a) Buffering adjoining and competing land uses;

(b) Landscaping parking lots with five (5) or more parking spaces or those areas two thousand five hundred (2,500) square feet or more devoted for vehicular use;

(c) Retaining existing trees in all residential subdivisions of more than five (5) lots, high-density development or planned development; and commercial, office and institutional and industrial developments.

(d) Landscaping for the above three (3) types of projects shall meet the general landscaping performance standards specified in section 18-448, additional performance standards, as applicable, shall also be met for buffer yards (Division VII of this article) and for parking lots (Division V of this article).

Sec. 18-448. - General standards for landscaping.

The following general standards shall be used in the process of designing all landscaping plans:

(1) Selection of plant materials. All plant materials and their spacing requirements, which are to be planted to meet the opacity and height requirements of this Article, shall be selected from the city's Technical Standards and Specifications Manual. The city manager may approve the use of trees not listed in the Technical Standards and Specifications Manual.

(2) Unless otherwise noted, all trees planted as a function of fulfilling the requirements of this Article shall be a minimum of two (2) to two and one-half (2½) inch caliper for shade canopy trees, eight (8) to ten (10) feet in height for understory and multi-trunk trees, and shrubs shall be a minimum of twelve (12) inches in height.

(b) Credit for preserved trees that are not otherwise required to be preserved by this Article and trees transplanted by spading may be allowed as follows:

(1) Credit towards landscaping requirements may be granted by the reviewing agency for healthy trees of at least two (2) inch caliper preserved or transplanted by spading from within the limits of disturbance or within the improved area of the project boundaries.

(2) Credit may be allowed for each tree preserved or transplanted at a rate in accordance with Table I below.

(3) Credit may be used to satisfy streetyard or parking lot requirements provided an overall landscaped effect is maintained and the parking facility shading requirements are achieved.

(4) Credit may be used to offset mitigation requirements.

(5) Credit may not be granted for single-family residential development except for retained trees in the common areas.

(6) Credit shall not be granted for trees preserved in a required buffer yard.

(c)

Credit calculation. Credit for preserved or transplanted trees shall be calculated using Table I. Inches DBH of applicable preserved trees shall be calculated cumulatively to determine the total credit for the site.

(d) Regardless of credit granted, fifteen (15) trees per disturbed acre, two (2) inches DBH or greater, must be retained or planted on the disturbed portion of the site, including trees located in the street yard and bufferyard. To meet this requirement, spading for the purpose of transplanting existing trees greater than four (4) inches is allowed.

(e) Provision for other uses. Up to fifteen (15) percent of the area to be landscaped may be covered with surfaces specifically intended to afford intensive use and enjoyment by employees or the public (such as walking paths, bench and table pads, etc.).

(f) Adequate vision clearance. All plantings shall be in accordance with section 18-556 of this chapter.

(g) Stormwater management systems shall be integrated into the landscaping plan by employing rain gardens, bioretention units, constructed wetlands, and infiltration areas, as combined landscaping/stormwater management features to the extent that soil permeability, depth to groundwater, or site encumbrances, such as utilities, allow.

(h) All trees and shrubs shall be adapted locally to the area. Native species and related cultivars are encouraged.

(i) Xeriscaping and use of drought tolerant landscape plantings is encouraged.

(j) Plantings shall be installed in a manner that is in visual harmony with existing and surrounding vegetation and topography, and ensures the availability of sufficient soil and water for healthy growth.

(k) Stormwater runoff shall be directed to landscape islands and planting areas to reduce irrigation needs and to take advantage of water quality and water recharge benefits to the extent that soil permeability, depth to groundwater, or site encumbrances, such as utilities, allow.

Table I. Credit for Preserved Trees

Preserved Trees (inches caliper or DBH)	Credit (required trees, pine plugs or shrubs)
2—5	1
6—11	2
12—17	3

18—23	4
> 24	(DBH/6)

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 24, 12-4-12)

Sec. 18-449. - Exemptions.

(a) Removal of trees on properties within the HD, HD-R, HD-MU and HD-O zoning districts shall be subject to review and approval by the historic preservation commission.

(b) Single-family detached residential lots of two (2) acres or less are exempt from this section. Exempt lots must be zoned single-family residential and contain a single-family use.

(c) All bona fide agricultural land use is exempt from this section.

(d) A property containing a contributing structure as listed in a National Register Historic District or individually listed in the National Register of Historic Places shall have flexible landscaping standards if it is determined by the city manager or designee, upon recommendations from the North Carolina State Historic Preservation Office, that adhering to the standards set forth in this article will detract from the historic character of the property.

(Ord. No. O-2008-25, 4-8-08)

Sec. 18-450. - Administration and enforcement.

(a) Before the issuance of a building permit for the construction, renovation or alteration of any structure, a landscape plan indicating the type, amount and location of any required landscaping prepared in conformance with the provision of this section shall be submitted by the property owner and shall be approved by the city manager.

(b) No certificate of occupancy for any construction or renovations shall be approved by the zoning inspector, until:

(1) The required landscaping is completed in accordance with the approved plan; or

(2) A letter of credit or certified check has been posted, which is available to the city, and in sufficient amount to assure installation of the required landscaping. The amount shall be submitted by the developer and reviewed by the city manager as to acceptability.

(3) No surety or portion thereof, as provided for in this section, shall be released by the city until all landscaping has been installed, inspected, and approved, and until all required certification of such approval has been presented to the city.

(c)

The board of adjustment may modify or waive the requirements of Division VII of this article, where it can be demonstrated by the property owner that the specific screening buffer or landscaped open space is not needed for the protection of surrounding residential areas because of intervening streets, roadways, drainageways, or other factors such as natural growth of sufficient height and density to serve the same purpose as the required screening buffer.

(d) If any requirements of this article conflict with other requirements of this ordinance, the more stringent or higher standard shall control over the less stringent or lower standard.

(Ord. No. O-2012-85, Exh. A, § 25, 12-4-12)

Secs. 18-451—18-454. - Reserved.

DIVISION II. - TREE PRESERVATION

Sec. 18-455. - General.

Vegetation existing on a site at the time of development that is required to be retained in accordance with the following provisions shall be inventoried on a tree survey. The inventory and identification shall be performed by a qualified professional and the location of existing vegetation shall be performed and certified by a professional land surveyor, and submitted as part of the site plan application. The inventory must include the size and species of each protected tree. The inventory must clearly indicate trees that are to be retained, and those for which removal is proposed. Areas that are designed as tree protection areas and that will not be disturbed can be delineated as such and do not require inventorying individual trees.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2010-91, § 29, 12-7-10)

Sec. 18-456. - Protected trees.

The following categories of existing vegetation shall be considered protected and shall be retained as indicated:

(a) *Regulated trees.* Hardwood trees at least eight (8) inches DBH, all conifer trees at least twelve (12) inches DBH, and all dogwoods, magnolias, other ornamental flowering trees, and American hollies at least four (4) inches DBH anywhere on the site shall be considered regulated and protected, and shall be preserved according to this chapter and incorporated into required landscaping. If these trees are removed, regardless of location on the site, they shall be mitigated with replacement trees in accordance with section 18-460, or by use of credits in accordance with section 18-448, unless the trees are shown to be dead, dying or

greater than fifty (50) percent damaged or diseased as a result of natural factors, or are otherwise exempted from mitigation. The total number of replacement trees shall be determined pursuant to section 18-460.

(b) *Significant trees.* Hardwood, long leaf pine, pocosin (pond) pine, black pine, and non-pine conifer trees at least twenty-four (24) inches DBH, all other pines at least thirty-two (32) inches DBH, and dogwoods, magnolias, American hollies and other ornamental flowering trees at least eight (8) inches DBH, anywhere on the site shall be considered significant and protected, and shall be preserved according to this chapter and incorporated into required landscaping. If these trees are removed, regardless of location on the site, they shall be mitigated with replacement trees in accordance with section 18-460, or by use of credits in accordance with section 18-448, unless the trees are shown to be dead, dying or greater than fifty (50) percent damaged or diseased as a result of natural factors, or are otherwise exempted. The total number of replacement trees shall be pursuant to section 18-460.

(c) *Street yards.* Any regulated or significant trees within required street yards shall be retained and supplemented as necessary to meet the street yard planting requirements.

(d) *Buffers.* Any existing trees or shrubs within required buffers shall be retained and supplemented as necessary with other plantings, fences, or berms to meet the buffer requirements. Vines and weeds may be cleared by hand or with hand-held tools, including hand-held power tools to improve the appearance of the buffer.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 26, 12-4-12)

Sec. 18-457. - Retention standards for protected trees.

Protected trees may be removed only if essential site improvements, as defined in Article 15 of this chapter, cannot be accommodated elsewhere on the site. If any protected trees are to be cleared from the site for essential site improvements, the proposed removal must be indicated, the reasons for doing so shall be clearly stated on the tree survey, and a tree removal permit must be obtained pursuant to Division III of this article. Such factors as nonselective clearing by bulldozer is less expensive than selective clearing by chainsaw or removal to accommodate nonessential site improvements shall not be valid reasons for removal of protected trees. Clearing of sites shall be limited to areas approved for construction.

(a) Every reasonable effort shall be made to protect and retain existing trees and shrubs not actually lying in planned roadways, drainage ways, building foundation footprints, and construction activity areas. Applicants shall contact the reviewing agency and the reviewing agency will determine whether a meeting is required prior to site plan development to evaluate the site and tree retention opportunities. Roadways and building sites should be planned to minimize the removal of protected trees.

(b)

No land disturbance, including removal of any trees, is permitted on areas outside of necessary grading limit for essential site improvements other than necessary to tie back into the existing contours, or to meet landscaping requirements.

(c) Significant trees must be preserved inside the limits of disturbance where possible. Trees requiring removal will be mitigated pursuant to section 18-460.

(d) Land clearing and construction contractors shall receive adequate instruction on tree protection requirements and methods.

(e) The following may be required or permitted by the reviewing agency to accommodate protected trees:

(1) Site sensitivity in location and designing parking, stormwater facilities, utilities, streets, and buildings in relation to existing topographic features and vegetative cover. Adjustments to the location or positioning of essential site improvements that do not compromise the intended use may be required.

(2) Reduction of parking to the minimum required per the zoning ordinance for the appropriate use.

(3) Reduction in required street yards, landscape islands, foundation plantings, or setbacks for the purpose of retaining trees.

(f) Wooded sites shall be developed with careful consideration of the natural characteristics of the site. Forested areas and vegetated areas unsuitable for development shall be preserved to the greatest extent practical and set aside as conservation areas, stormwater treatment areas, or open space.

(g) A minimum of fifteen (15) trees at least two (2) inches DBH shall be retained or planted on the parcel for each acre or proportionate area disturbed by development.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 27, 12-4-12)

Sec. 18-458. - Tree protection during construction.

(a) To preserve existing trees specified on the required landscape plan to remain on the site as a function of fulfilling purposes of this section, the critical root zone shall be protected by proper installation of barricades and signage from vehicular movement, material storage, compacting, grading, excavating, and other development related activities during construction and in the final landscape design.

(b) The critical root zone (CRZ) shall be protected during construction by approved tree protection fencing and practices. Tree protective fencing shall be shown on site plans and grading plans around each tree, cluster of trees, at perimeter of tree-save areas, and at limits of disturbance.

No equipment is allowed on the site until all tree protection fencing and silt fencing has been installed and approved. Tree protective fencing shall remain in place through completion of construction activities.

(c) If the entire CRZ cannot be preserved, the disturbed area shall extend no closer to the protected tree trunk than one half (½) the radius of the CRZ. In no case can more than forty (40) percent of the CRZ be disturbed.

(d) Disturbance of the CRZ will only be allowed on one (1) side of the retained tree and only with prior approval by the appropriate reviewing agency.

(e) Prior to grading, tree roots shall be pruned using appropriate arboriculture pruning tools and practices.

(f) Disturbance other than that allowed on the approved plan, including incorrectly placed tree protection fencing or improper root pruning constitutes negligence and will require the owner to post an irrevocable letter of credit or other means of financial assurance approved by the reviewing agency for three (3) years to provide for mitigation of the tree per section 18-460 to be released if determined by the reviewing agency that the tree is not at risk of dying due to the disturbance.

(g) Any person who is responsible for failing to properly install or maintain protection measures pursuant to this article shall be subject to a fine of five hundred dollars ($500.00) per day and a stop work order shall be placed on the project. The owner of the property shall also be a jointly and severally responsible party if the improper practices are conducted by an employee, agent, or other person under the control, employ, or direction of the property owner.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 28, 12-4-12)

Sec. 18-459. - Negligence.

If a tree required to be protected is destroyed, substantially damaged, or dies as a result of negligence or failure to comply with the requirements of this section on the part of any property owner and/or agent of the owner, within three (3) years after completion of construction, then replacement trees of a similar species shall be planted on the site pursuant to section 18-460.

Sec. 18-460. - Mitigation.

(a) Protected trees. Protected trees shall be mitigated on the site using trees of equal or higher value in Table IV and of the size specified in section 18-448.

(b) Significant trees. The total number of replacement trees shall be determined by multiplying the total DBH of the removed significant trees by two (2) times the percentage for the type of tree in Table IV and dividing by three (3).

(c)

Regulated trees. The total number of replacement trees shall be determined for regulated trees removed by multiplying the total DBH of the removed regulated tree(s) by the percentage for the type of tree in Table IV and dividing by three (3).

(d) A minimum growing area of one hundred forty-four (144) square feet of pervious surface shall be provided for each replacement tree.

(e) Pines may be mitigated on site with long-leaf pine plugs spaced ten (10) feet apart at a rate of one (1) plug per inch DBH of the removed tree multiplied by the percentage in Table IV divided by three (3). Alternatively, up to one-half (½) of the pine plugs required for replacement may be substituted with replacement hardwoods of equal or higher value in Table IV at the rate of one (1) hardwood per pine plug required.

(f) If in the determination of the city manager, the site cannot accommodate the required numbers of trees or pine plugs, then only the amount of trees or pine plugs which can be accommodated on the site will be replaced and the remainder of caliper inches shall be mitigated through a payment in lieu of providing on-site trees. This payment shall be made into the City Tree Improvement Fund to be used for plantings of public spaces in the general vicinity of the project. The amount of the payment shall be in accordance with the pricing standards of the respective jurisdiction.

(g) Mitigation payment in lieu will not be required if in the judgment of the reviewing agency trees are retained on the site to the maximum extent practical, and the following conditions are met:

(1) The site has a definable street yard with canopy that exceeds the standard width made up at least in part by retained tree clusters;

(2) The site exceeds the buffer requirements, at least in part by retained trees, tree clusters, and vegetation;

(3) The site exceeds the interior parking area landscaping minimum percent coverage requirements, at least in part by retained trees and tree clusters; and

(4) A minimum DBH of one hundred seventy-five (175) inches per acre of trees of two (2) inches DBH or greater is retained on the site in natural clusters.

(h) Any mitigation trees required as a result of the removal of protected tree(s) shall not be counted to meet the requirements of the street yard, buffers or interior parking requirements. These trees must be provided in addition to any tree required by this ordinance.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 29, 12-4-12)

Sec. 18-461. - Exemptions to mitigation.

(a) Protected trees removed within the footprint of the lot coverage are exempt from mitigation, provided the total building footprint does not exceed twenty-five (25) percent of the total lot area, and provided that the applicant has designed around trees in order to retain as many trees as

practicable.

(b) Regulated trees removed within the area of disturbance necessary for essential site improvements are exempt from mitigation, provided the applicant has designed around trees in order to retain as many trees as practicable.

(c) Protected trees that are removed by spading the trees and planted elsewhere on the site are exempt from mitigation. Additionally, protected trees that are removed by spading and accepted by the city for planting on public property at the location designated by the city manager are exempt from mitigation. Any tree that has been transplanted for the purpose of this section and that becomes diseased or dies within three (3) years of transplanting shall be replanted by the party requesting the exemption with a tree of the same species and size or mitigated pursuant to this article.

(Ord. No. O-2008-25, 4-8-08)

Sec. 18-462. - Landscaping plans.

Landscaping plans shall be submitted before or at the time of application for the building permit for all development projects. These plans shall contain the following information.

(a) Date of plan preparation.

(b) Project name and description of land use.

(c) Project owner and mailing address.

(d) A map at a scale of one (1) inch equals one hundred (100) feet (1"=100') or less showing:

(1) North arrow.

(2) Scale.

(3) Approximate locations, species, and critical root zones of all protected trees. Groves of protected trees that will not be disturbed may be labeled as such on the map, stating the approximate number of protected trees and species mix, without specifying data on each individual tree.

(4) Note on plan stating that prior to any clearing, grading, or construction activity, tree protection fencing will be installed around protected trees or groves of trees. No construction workers, tools, materials, or vehicles are permitted within the tree protection fencing.

(5) Locations, dimensions, and square footages of required buffer yards and parking lot landscaping.

(6) Details of required landscaping showing species, dimensions, and spacing of planted materials and the use and protection of existing vegetation.

(7) All existing and proposed utilities and if applicable, their associated easements.

(8) Location and square footage of structures and parking lots.

(9) Adjacent zoning districts.

(10) Approximate locations of all trees greater than eight (8) inches DBH within required buffers and of all areas of natural vegetation to be used as part of the buffer.

(11) Setbacks of all structures and specifications and shielding of certain uses, as required.

(12) Locations of any conservation resources associated with the parcel including any rare and endangered species in accordance with the North Carolina Wildlife Resources Commission.

(13) Proposed schedule for landscaping.

(14) Approximate location of all existing protected trees clearly indicating those to be retained and those proposed for removal and all trees to be planted on site to meet any mitigation requirements.

(15) Triangular sight distance.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 30, 12-4-12)

Secs. 18-463—18-470. - Reserved.

DIVISION III. - TREE REMOVAL

Sec. 18-471. - Permits required.

No person, directly or indirectly, shall remove any tree from public or private property without first obtaining a tree removal permit from the city manager. A tree removal permit is required before any clearing; grading or other authorizations may be issued including soil and sedimentation control permits and building permits. An approved tree removal permit for new construction shall apply to the entire site. The tree removal permit and approved tree preservation plan shall be posted at the job site with other permits for the duration of work on the site. A tree removal permit may be either attached to the submitted site plan or the site plan may be clearly marked for either approval or denial.

The city may withhold or withdraw any city-issued permits, certificates and other authorizations, including, but not limited to, building permits and certificates of occupancy, until a tree removal permit is obtained. A tree removal permit or exemption from permit must be obtained before a soil and sedimentation control permit or building permit may be issued.

(Ord. No. O-2008-25, 4-8-08)

Sec. 18-472. - Procedure.

Applications for tree removal permits shall be submitted to the city manager on forms established by the city and made available to the public. The city manager shall review all complete applications for tree removal permits and act to grant or deny the permit in accordance with this section. In applying the provisions of this article, the applicant shall signify that the person performing the work under the tree-removal permit is knowledgeable of both the ANSI standards and the OSHA standards for tree pruning, removal, and safety and that they are insured against potential damages or shall seek technical assistance from landscaping or arboriculture professionals that are knowledgeable of these standards and that are insured against potential damages. The application must be accompanied by a fee, as set forth in the fee schedule, and three (3) sets of plans showing the trees proposed for removal and those trees or natural areas proposed to be saved.

(Ord. No. O-2008-25, 4-8-08)

Sec. 18-473. - Waivers, exemptions and exceptions.

(a) The city manager may waive the requirements of this division during an emergency such as a hurricane, tornado, windstorm, tropical storm, flood, or other act of God.

(b) If any protected tree shall be determined to be in a hazardous condition so as to (1) immediately endanger the public health, safety, or welfare, or (2) cause an immediate disruption of public services, the city manager may authorize removal of the tree without a written permit. Following removal, the city manager may determine that replacement with additional trees is necessary. In making a determination, the city manager shall utilize such professional criteria and technical assistance as may be necessary.

(Ord. No. O-2012-85, Exh. A, § 31, 12-4-12)

Sec. 18-474. - Criteria for permit issuance.

Tree removal permits shall be issued upon a determination by the city manager that the application complies with all applicable standards of this section and that any of the following conditions exist:

(a) Essential site improvements cannot be accommodated on the site without the removal of protected trees;

(b) A protected tree is dead, severely diseased, injured, or in danger of falling close to existing or proposed structures; for those protected trees that meet or exceed the definition of "significant" tree, their removal must be mitigated as directed in section 18-460. If the tree is determined to have died or is significantly damaged as a result of natural disaster then no mitigation will be required unless the tree is needed to meet the minimum number required on the site;

(c)

The protected tree is causing disruption of existing utility service or causing drainage or passage problems upon the right-of-way;

(d) The protected tree is posing an identifiable threat to pedestrian or vehicular safety;

(e) The protected tree violates state and local safety standards; or

(f) Removal of the protected tree is necessary to enhance or benefit the health or condition of adjacent trees or property.

(Ord. No. O-2008-25, 4-8-08)

Secs. 18-475—18-476. - Reserved.

DIVISION IV. - STREET YARD LANDSCAPING

Sec. 18-477. - General.

(a) A street yard, as defined herein, must be provided for new construction of principal structures or for expansions to existing structures or uses whenever additional off-street parking is required. However no street yard improvements shall be required for those portions of lot frontage used for driveways constructed in accordance with city or state driveway regulations.

(b) It is intended that street yards be landscaped by meeting the requirements of either the following minimum standard or creative standard [subsection (1) or (2)]. All street yards shall be landscaped with a combination of live vegetation, groundcover, grass, trees, or shrubs. Vegetation to be located pursuant to this section shall be selected from the "Approved Plantings List" in the City of Wilmington Technical Standards and Specifications Manual.

(1) Minimum standard: For every six hundred (600) square feet of street yard area, the street yard shall contain:

a. One (1) canopy/shade tree as specified in section 18-448; or

b. In areas where overhead power lines prohibit canopy trees in the street yard, three (3) standard understory trees may be substituted.

c. Six (6) shrubs, twelve (12) inches in height at planting.

(2) Creative standard: To promote creative designs, street yards may consist of trees and shrubbery which cover at least fifty (50) percent of its area.

(3) Stormwater management systems may be allowed in required street yard areas provided the required plantings can be accommodated and the overall plan maintains an attractive landscaped effect. Protected trees may not be removed from required street yard areas specifically to accommodate stormwater facilities. Stormwater facilities installed within the

street yard area shall be designed in accordance with the technical standards for "Landscape Stormwater Facilities" or an alternative wetland, bioretention, or other design approved by the city manager.

(4) No more than fifteen (15) percent of the required street yard shall be covered with an impervious surface. This portion of the street yard may be used for walkways, fountains, walls or fences but no parking areas shall be permitted in these designated areas.

(c) If there are existing trees in the proposed street yard area, the city manager may grant credit toward meeting tree preservation requirements, provided their caliper is at least two (2) inches or more. In addition, the city manager may require the saving of any protected tree in the street yard area.

(d) The street yard is calculated by multiplying the designated street yard factor in accordance with the zoning designation of the property by the linear street frontage of the subject property minus the width of all approved driveways. The resultant square footage is required to be installed as the minimum street yard amount. The applicant may install the street yard in any configuration that provides the required amount of street yard square footage between the property line and any site improvements. The maximum and minimum widths as listed in Table II may not be exceeded in any portion of the street yard.

Table II. Street Yard Calculations

Zoning District	Multiplier	Maximum Width	Minimum Width
RB, CS, AI, LI, IND	25	37.5	12.5
CB, NB, O&I and all MF districts	18	27	9
All non single-family uses in Residential Districts	12	18	8

(e) The applicant may choose to increase the street yard multiplier up to twenty-five (25) percent above the stated multiplier in Table II, and receive an equivalent reduction in the building's front yard setback.

(f) For all lots of record prior to the adoption of these requirements of two (2) acres or less, if the city manager determines that the essential site improvements cannot be accommodated under the current requirements, then the required street yard square footage may be reduced up to one-

half (½), but in no case shall be less than one-half (½).

(g) Street yards shall be required along all street frontages. For sites with two (2) or more street frontages, only the primary street frontage must contain the full amount of street yard as indicated in Table II; all secondary street frontages shall contain one-half (½) the required square footage amount as indicated in Table II.

(h) [Buffer strips may] be required along all street frontages. When reviewing the development plan, the city manager, may require buffer strips, as regulated in Division VII of this article, along the street frontage to protect adjoining land uses, particularly residential, from the impacts of more intense developments

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2010-91, § 30, 12-7-10)

Sec. 18-478. - Exceptions to street yard landscaping requirements.

For developments within the 1945 corporate limits of the City of Wilmington: when, in the determination of the city manager or designee, conditions exist peculiar to the site that prevent the full width of the required street yard from being installed, the street yard multiplier may be reduced up to and including full exemption. Applicable conditions would include but not be limited to: essential site improvements; providing for ingress, egress, and circulation for the site and when structures existing on the block are within the required street yard. In these circumstances, the street yard shall be reduced only to the width necessary to accommodate such conditions.

(Ord. No. O-2009-45, § 1, 6-2-09)

Secs. 18-479, 18-480. - Reserved.

DIVISION V. - PARKING LOT LANDSCAPING

Sec. 18-481. - Interior area landscaping.

The interior area of a parking facility shall be shaded by canopy trees either planted or retained to provide twenty (20) percent or greater canopy coverage at maturity. For purposes of this section, a parking facility shall include any areas of a development devoted to pedestrian or vehicular use, including, but not limited to, parking areas, loading spaces, automobile sales lots, driveways and internal drive aisles. The following standards shall apply to interior parking area landscaping:

(a) All single planting islands measuring twelve (12) feet by eighteen (18) feet or having the equivalent square footage shall have at least one (1) tree. All double planting islands measuring twelve (12) feet by thirty-six (36) feet or having the equivalent square footage shall have at least two (2) small mature shade trees or one canopy tree. All larger planting islands

will have additional trees in increments of one (1) tree for each additional two hundred (200) square feet if installing small shade trees or one (1) tree for every four hundred (400) square feet if installing canopy trees. All planting islands shall have additional ground cover or shrubbery from the approved plantings list to cover the entire landscaped island, subject to the walkway allowance as indicated below. At least seventy-five (75) percent of the trees required hereunder shall be of a large shade/canopy species as defined in the approved plantings list that have or will have at maturity a DBH of at least twelve (12) inches. Small maturing shade trees may be planted where overhead power lines would interfere with normal growth or for site design considerations, if trees are maintained in their natural form.

(b) Interior landscaping within automobile sales lots may be distributed so that smaller shade trees are utilized toward the interior of the lot, and larger shade trees are placed toward the perimeter, provided the twenty (20) percent canopy cover of the parking facility is achieved. In no case shall any merchandise from these uses be displayed within a required landscape area.

(c) Up to fifteen (15) percent of a landscaped island may be devoted to pedestrian walkways, as needed.

(d) The planting size for interior trees shall be as specified in section 18-448.

(e) All plantings shall be evenly distributed throughout the parking facility unless reconfiguration has been allowed pursuant to this article to retain existing vegetation and provided the twenty (20) percent canopy cover is achieved.

(f) All interior plantings shall be curbed or otherwise physically protected such as by wheel stops. If curbing is used, however, curb openings shall be installed to allow passage of stormwater into landscaped areas designed with depressed contours for infiltration.

(g) Consecutive parking spaces shall incorporate landscaped islands at the ends of all parking rows and within the rows, such that no parking space is located more than one hundred twenty (120) feet from a planting island or peninsula unless reconfiguration has been allowed pursuant to this Article to retain existing vegetation and provided the twenty (20) percent canopy cover is achieved. Islands shall contain at least two hundred sixteen (216) square feet in area and be at least twelve (12) feet in width, measured from back of curb barrier to back of curb barrier. Depressions in interior and perimeter landscaping in combination with curb openings, grading to deliver runoff from parking lot to landscaped areas, and overflow control shall be used where feasible and where soils permit for creating bio-retention and infiltration areas for water quality protection and groundwater recharge.

(h) Interior landscaping requirements may be waived to allow reconfiguring of designs to retain existing trees in or adjacent to parking areas. Barriers are still required at the ends of parking lanes where necessary to aid safe flow of traffic.

(i) Parking facilities landscaping for the O&I and NB Districts shall include the following additional shading requirements reflecting the amount of impervious surface which is proposed:

Impervious Surface (square feet)	Required Interior Shading (percent)
0—10,000	20
10,000—25,000	25
25,000—50,000	30
50,000—100,000	35
100,000+	40

(j) For purposes of determining if the landscape plan meets the shading requirements of this section, each canopy tree of the type described in this section shall be presumed to shade a circular area of seven hundred and seven (707) square feet (based on having a canopy radius of fifteen (15) feet with the trunk of the tree as the center). When smaller shade trees are planted, each tree shall be presumed to shade a circular area of three hundred and fourteen (314) square feet (based on having a canopy radius of ten (10) feet). Perimeter trees shall be given credit for that portion of the area of the canopy that overlays the parking area. Using this standard, twenty (20) percent of the parking facility area must have canopy coverage. For existing trees, credit shall be given for the actual canopy overhanging the parking facility. The trees counted toward meeting the shading requirement shall be indicated and calculations shall be shown on the landscape plan.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 32, 12-4-12)

Sec. 18-482. - Perimeter landscaping.

(a) A landscaped yard ten (10) feet in width shall be required along any side of a parking lot abutting a separate parking lot, driveway, or residentially-zoned property. Plantings shall consist, at a minimum of one (1) tree of the size specified in section 18-448 every eighteen (18) to twenty seven (27) feet. If a buffer yard or street yard is required in accordance with the provisions of this ordinance then the ten (10) foot width may be included as part of the buffer yard or street yard.

The landscaped yard may be interrupted by driveway connections between parking lots. If adjacent parking lots are developed concurrently then both properties can install a minimum of five-foot yard or any multiple agreed upon in writing by the two (2) property owners that would equal ten (10) feet of planted area between the parking lots. Adjacent lots that choose to share a double parking row split down the middle of a drive isle are exempt from this requirement. Perimeter landscaping areas shall be designed with depressed contours and curb openings to receive surface flow directed from parking lot runoff where feasible for creating bioretention and infiltration areas for water quality protection and groundwater recharge.

(b) For redevelopment of nonconforming parking facilities containing five (5) to twenty-five (25) parking stalls inclusive, a perimeter landscape yard may be provided in lieu of interior landscaping, subject to the following requirements:

(1) The minimum width of such yard shall be ten (10) feet.

(2) For every forty (40) linear feet or fraction thereof, the perimeter landscape yard shall contain one (1) canopy tree or three (3) understory trees of the size specified in section 18-448 and a continuous row of evergreen shrubs at least eighteen (18) inches in height.

(3) Where a perimeter landscape yard overlaps a streetyard or buffer yard required elsewhere in this chapter, the more stringent or higher standard shall control over the less stringent or lower standard.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 33, 12-4-12)

Sec. 18-483. - Parking area screening.

When a parking facility is within fifty (50) feet of a right-of-way, if the buffer yard provisions of this ordinance do not call for a planted buffer, a low buffer shall be incorporated into the street yard to provide protection from vehicle headlights within the parking lot. The buffer shall consist of shrubbery, a grade change or planted berm or any combination thereof that serves to shield traffic on the right-of-way from headlights within the parking lot. The buffer shall be a minimum of three (3) feet in height and five (5) feet in width and may be incorporated in a street yard, provided the street yard is fifteen (15) feet or more in width. Depressions and curb cuts shall be allowed for water quality protection.

Sec. 18-484. - Waivers.

(a) The city manager may waive all or part of the requirements of this division for any facility which is limited to periodic or intermittent use for vehicular parking lots for churches or recreational facilities, provided the facility is completely covered by grass or otherwise presents a landscaped effect.

(b)

The city manager may waive the requirements of this division for temporary parking lots when in their determination a waiver will not violate the purposes of this section. Any such waiver shall not exceed one (1) year.

Secs. 18-485—18-489. - Reserved.

DIVISION VI. - FOUNDATION PLANTINGS

Sec. 18-490. - Foundation plantings.

For all portions of buildings which are adjacent to parking facilities or internal drive aisles, foundation plantings shall be required and located between the building's facades and the parking or drive aisle curb. The minimum standards are required; however, it is encouraged that sites exceed the minimum whenever possible. The following minimum standards shall apply:

(a) The area of the building face adjacent to the parking area or internal drive aisle shall be computed and multiplied by a minimum of twelve (12) percent. The resultant total square footage shall be planted as landscaped areas of sufficient variety, height, and size, with plantings listed in the "Approved Plantings List" of the City of Wilmington Technical Standards and Specifications Manual.

(b) Exemptions from this requirements may be granted when the following circumstances exist or when any of the following conditions are proposed on the site:

1. For those portions of buildings which have drive-up services along any side of the building. (Such examples would include, but not be limited to, pharmacies, banks, fast food restaurants, and dry cleaners.)
2. On the rear side of a building when less than ten (10) percent of the total required parking is located in the rear of the building and the rear is not adjacent to any public right-of-way.

(Ord. No. O-2008-25, 4-8-08; Ord. No. O-2012-85, Exh. A, § 34, 12-4-12)

Secs. 18-491—18-495. - Reserved.

DIVISION VII. - BUFFER YARDS

Sec. 18-496. - Purpose.

Buffer yards are designed to protect adjoining land uses, particularly residential, from the noise, heat, dust, lights, threats to privacy, and aesthetic impacts from more intense land uses. Buffer yards shall be required along all property lines adjacent to a residential use or district, except where a reduced building setback precludes placement of a buffer yard in situations where the adjoining property contains a nonresidential use of residentially zoned property, such as a church or school. The more intense land use shall be required to provide the buffer as part of its yard requirements. The following requirements shall be met for buffer yards and the yards in which buffers are required.

Sec. 18-497. - Location of buffer yards.

Buffer yards shall be required to screen any residential use from any nonresidential uses or districts. Buffer yards shall also be required to screen any residential use or district from any attached housing development or mobile home park or high-density development or Planned Development. However, no buffer yard will be required for high density detached lots provided lots equal or exceed five thousand (5,000) square feet.

(a) The exact location and arrangement of materials and plantings in the buffer yards will be determined based upon an analysis of site topography and sight lines from public spaces or private properties which are to be protected.

(b) Where practical, buffer strips will be designed to facilitate stormwater management objectives, including bio-retention, constructed wetlands, and infiltration except where it would result in damage or removal of existing vegetation otherwise required to be preserved.

Sec. 18-498. - Width of buffer yards.

Buffer yards shall have a base width equal to at least fifty (50) percent of the required setback. In all cases the base of the buffer yard shall be equal to or greater than twenty (20) feet, except as allowed in this article. Where a utility easement occupies a portion of the buffer yard, sufficient buffer width must be provided outside the utility easement to meet the required opacity standards.

Sec. 18-499. - Site constraints.

In the event that preexisting conditions on an infill, redevelopment or expansion project within the city limits result in site constraints (i.e. small lot, drainage swale, etc) that prevent meeting the standard options for buffer yards as required in this section, the city manager may alter the buffer yard requirements to no less than ten (10) feet with a solid eight (8) to ten (10) foot fence provided the spirit and intent of this section is met. Such an allowance will only be made at the request of the applicant, who shall submit a plan showing

how the proposed buffer would screen the intended use. The allowance will not be granted without documenting to the satisfaction of the city manager that constraints on the site prohibit otherwise meeting the requirements of this section.

Sec. 18-500. - Allowance for a decreased setback width and increase in buffer width.

The setback for structures may be decreased if the base width of the buffer yard as determined by this article is increased by the same amount.

Sec. 18-501. - Uses in the buffer.

No activities shall occur in the buffer except for maintenance of the buffer and the installation and maintenance of water, sewer, electrical and other utility systems where the installation causes minimal disturbance of existing vegetation. No buffer yard required by this section may contain any building or structure, or extension of any building or structure mechanical system. This prohibition shall apply at the time of issuance of a certificate of occupancy and at any time thereafter, and shall include, but not be limited to, porches, decks, patios, HVAC system components, waste containers, storage buildings or any other fixture or structure, whether temporary or permanent.

Sec. 18-502. - Uses in the rear and side yards abutting a residential use.

The following uses shall be shielded from view from the property line of the residential use or district by means of a one hundred (100) percent opaque solid wall:

(a) Dumpsters or other trash holding areas.

(b) Outside storage areas.

(c) Loading/unloading areas.

(d) Heating/air-conditioning units including roof-mounted units.

Sec. 18-503. - Types of buffer yards.

Buffer yards shall provide approximately one hundred (100) percent opacity with plantings as specified in the approved plantings list. Buffer yards may be occupied only by natural and/or planted vegetation, berms, and fencing as specified below. For all types, however, the planted material shall be a combination of trees and shrubs.

(a) Natural vegetation must be retained in accordance with Division II of this article.

(b) One (1) or more of the following means shall be used to supplement the natural vegetation as necessary or to provide an adequate buffer where no natural vegetation exists:

(1)

Planted buffer yards—The planted buffer yards shall perform as "opaque screens" achieving one hundred (100) percent opacity from the ground to a height of six (6) feet, with intermittent visual obstructions from the opaque portion to a height of at least twenty (20) feet, within three (3) years of planting. Trees shall be of the size specified in section 18-448 at planting, and should be selected from the screening tree list. Shrubs shall be a minimum of three (3) feet high at planting. To provide a variety of height and depth, at least one (1) tree on average will be planted for every thirty (30) linear feet of screen. Spacing of trees should be varied from straight lines and equidistant spacing where practical. Clustering and/or random spacing of plants and trees is encouraged to produce a natural appearance in the landscape to the extent that the planting meets the screening and opacity intent of this section. Trees should be placed and spaced to provide visual aesthetic appeal; to accommodate specific growth habits of species used; to incorporate existing trees into the screen; and clustered where appropriate to provide the maximum visual buffering protection to the adjacent use.

(2) Compliance of planted vegetation screens or natural vegetation will be determined on the basis of the average mature height and density of foliage of the subject species, or field observation of existing vegetation. The opaque portion of the screen must be opaque in all seasons of the year. At maturity, the portion of intermittent visual obstruction should not leave any completely unobstructed openings of more than ten (10) feet wide where it is providing screening of structures. The portion of intermittent visual obstructions may contain deciduous plants.

(c) Combination planted buffer yard with artificial fencing:

(1) Artificial fencing shall be between six (6) and ten (10) feet in height

(2) If solid artificial fencing is used two (2) rows of planted materials consisting of a combination of trees and shrubs shall be provided at a minimum height of three (3) feet at initial planting and give at least fifty (50) percent visual opacity of the fence at planting;

(3) If permeable artificial fencing is used, two (2) rows of planted materials shall be provided which give approximately one hundred (100) percent visual opacity of the fence within three (3) years of planting.

(4) The buffer vegetation shall be located between the fence and the common property line.

(d) Combination berm with vegetation:

(1) An earthen berm may be used in conjunction with planted vegetation provided that the combined height of the berm and planted vegetation shall be at least six (6) feet and provide approximately one hundred (100) percent opacity within three (3) years of planting.

(2) The slope of the berm shall be stabilized with vegetation and no steeper than 3:1. The height of the berm shall be six (6) feet or less with a level or rounded area on top of the berm. The berm shall be constructed of compacted earth.

(3) The berm shall be designed to prevent standing water or to impede the flow of stormwater from adjacent properties.

(4) Any berm shall be substantially planted and covered with live vegetation. No berm shall be vegetated entirely with Turf grass or ground cover.

(5) For berms greater than two (2) feet in height, all trees shall be planted within two (2) vertical feet of natural grade and shall be species that have no-to-low irrigation requirements, unless on-site surface water is used for irrigation.

(6) Berms are not permitted where installation will destroy or damage trees that are required to be retained under this section, or existing trees and other vegetation that functionally meet or partially meet the buffer requirements of this section.

Sec. 18-504. - Screening for dumpsters and outside storage areas.

For any of the following uses located within the view of any adjacent property or right-of-way, a visual screen shall be required to shield the use from the view of any adjacent property or right-of-way. Screening shall be a minimum of six (6) feet in height along the front or corner side of any lot and eight (8) feet in height along any side or rear property line. Chain link fencing shall not be permitted as a screening alternative. The screening shall consist of living and nonliving material as specified in this article. No screening shall be required along any side and/or rear property line that is adjacent to any manufacturing or industrial use, or when adjacent to any business which operates a towing service or whose principal use is "automotive repair".

(a) The rear side of a building where that side abuts a street right-of-way, or any dumpster or trash receptacle storage area, or service entrances and loading docks used in connection with any business establishment.

(b) Any outside storage area for vehicles awaiting repair in connection with any automotive or towing business.

(c) Any outside storage area for any equipment used in excavation, building site preparation, or construction. No part of any equipment stored in such area may project above the screen.

(d) Any ground level mechanical equipment such as HVAC, Electrical panels and similar mechanical equipment.

Sec. 18-505. - Exceptions to buffer yard requirements.

For developments located in the CBD, Central Business District or for lots of record in the HD-MU, MS-MU, and the 1945 corporate limits of the City of Wilmington: When in the determination of the city manager or designee, conditions exist peculiar to the site that prevent the full width of the buffer from being installed, the buffer width requirements may be reduced up to and including full exemption. Applicable

conditions would include but not be limited to: essential site improvements; providing for safe ingress, egress, and circulation for the site and when structures exist within the required buffer yard. In these events, the buffer yard shall only be reduced to that width which is necessary to accommodate such needs.

Secs. 18-506—18-509. - Reserved.

DIVISION VIII. - LANDSCAPING FOR EXPANSIONS TO EXISTING PRINCIPAL STRUCTURES OR USES

Sec. 18-510. - General.

For expansions to existing principal structures or uses, the following table shall be utilized in calculating the landscaping upgrade required for the previously developed portions of the site (up to the maximum landscaping requirements of this article). All newly developed portions of the site shall be subject to the full landscaping requirements of this article. For expansions where options are listed for street yard and parking facility landscaping, the higher option shall be utilized except where the city manager has determined that practical difficulties in site development exist in which the lower option is preferable.

Table III. Requirements for Expansion

Expansion	Trees	Street Yard	Interior Landscaping	Buffer Yard
10—25% increase in gross floor area or vehicular use area or 5—20 new parking spaces whichever is more restrictive	15 per disturbed acre	½ the required for new construction	4 percent	Fence or ½ the width of the required buffer for new construction
26—50% increase in gross floor area or vehicular use area; or over 10,000 sq. ft. increase in gross floor area; or 21—50 new parking spaces whichever is more restrictive	15 per disturbed acre	Full width; or ½ the required width for new construction	4 percent 6 percent	A fence and ½ the width of the required buffer for new construction

Greater than 50% increase in gross floor area or vehicular use area; or over 20,000 sq. ft. increase in gross floor area; or more than 50 new parking spaces whichever is more restrictive	15 per disturbed acre	Full width as required for new construction	8 percent	Full buffering as required for new construction

(a) When subdivision of previously developed property occurs and a building permit for new construction is obtained for any newly created tract within two (2) years of the date that the final subdivision plat was approved, all parcels of the original tract shall be subject to the above provisions for expansions to existing structures or uses.

(b) For consecutive expansions occurring within a two-year period, the amount of the expansions shall be summed and the maximum landscaping requirements for the total extent of the expansions shall be provided.

(c) Not withstanding the above requirements, expansions to existing structures or uses amounting to not more than a total increase of five hundred (500) square feet in gross floor area over a two-year period shall be exempted from meeting the street yard and parking facility landscaping requirements.

(Ord. No. O-2008-25, 4-8-08)

Secs. 18-511—18-514. - Reserved.

DIVISION IX. - MAINTENANCE

Sec. 18-515. - General.

(a) All planted and retained living material, required to meet the provisions of this section, shall be perpetually protected and maintained to professionally accepted standards by joint and several responsibility of the owner, occupant, tenant, and respective agents of the property on which the material is located. Maintenance of trees on nonresidential property shall be performed by a professional that has signified that they are knowledgeable of both the ANSI standards and the OSHA standards for tree pruning, removal, and safety and that they are insured against potential damages. Any planted material that becomes damaged or diseased or dies, or is improperly maintained shall be replaced by the owner within sixty (60) days of the occurrence of such

condition. If in the opinion of the city manager, there are seasonal conditions which will not permit the timely replacement of the vegetation (e.g., too hot or too cool for successful replanting) this requirement may be administratively waived until a time certain such that the replanting would be safe.

(b) In addition to requirements for replacement, any person who is responsible for improper maintenance practices of trees on private or public property shall be subject to a fine of four hundred dollars ($400.00) per tree. The owner of the property shall also be a responsible party if the improper practices are conducted by an employee, agent, or other person under the control or direction of the property owner. Improper maintenance practices for the purpose of this section means any of the following:

(1) Topping a tree (cutting a significant portion of the terminal growth);

(2) Cutting upon a tree that destroys its natural habit and pattern of growth;

(3) Pruning that leaves stubs or results in a flush cut, or splitting of limbs;

(4) Use of climbing spikes, nails or hooks, except for the purpose of total tree removal or as specified by the American National Standards Institute.

(c) Waivers may be made to the issuance of penalties for improper maintenance practices, provided one (1) of the following can be shown:

(1) The improper maintenance is necessary to alleviate a dangerous condition posing an imminent threat to the public or property;

(2) Franchised utilities may obtain a permit from the city, renewable on an annual basis, authorizing the pruning of trees in a manner that may be defined herein as improper provided such pruning is necessary to prevent service interruptions;

(3) Any person may apply to the development services department for an administrative waiver from the terms of this section, provided that:

a. The application is made before any actions for which a waiver is sought have been undertaken;

b. There are unique and special circumstances or conditions applying to the subject tree or the property upon which it is located, that do not apply generally to other trees or properties;

c. The waiver proposed is no more than necessary to alleviate the hardship;

d. That the granting of the waiver will be in harmony with the general intent and purposes of this section and will not create a dangerous condition that threatens the public or property.

(d) Nonliving screening buffers shall be maintained cleaned and repaired by the owner of the property on which the buffer is located. Such buffers shall be kept free of litter and advertising.

(e)

Buffers that over a period of time lose their screening functionality shall be replanted to meet the requirements of this ordinance.

(Ord. No. O-2008-25, 4-8-08)

Secs. 18-516—18-519. - Reserved.

DIVISION X. - AUTHORITY TO TREAT OR REMOVE TREES ON PRIVATE PROPERTY

Sec. 18-520. - General.

(a) The city manager may cause or order removal of any tree or part thereof on public or private property which is in an unsafe condition, damaging to sewers or other public improvements facilities, or infested by an injurious fungus, disease, insect or other pest.

(b) The city manager may cause or order necessary treatment for any tree on public or private property which is infested by any injurious fungus, disease, insect or other pest when he determines such action is necessary to prevent the spread of any such injurious condition or pest and to prevent danger therefrom to persons or property or to vegetation planted on adjacent property.

(c) Before exercising the authority conferred by this section, the city manager shall order the owner or occupant of the property to take corrective action. The order shall be in writing and shall state that the action specified then must be taken within ten (10) consecutive calendar days after the order is mailed. If the condition has not been corrected within the time specified above, the city manager may enter upon the property, perform the work necessary to correct the condition and bill the owner or occupant of the property for the actual costs incurred. The costs of such work if not paid, shall constitute a lien against the property.

(d) No foliage shall be allowed to extend from public or private property into any portion of a street right-of-way below a height of eight (8) feet above the grade of the sidewalk at the property line or if no sidewalk grade has been established the height shall be measured vertically above the center of the roadway. The city manager may cause or order corrective action to prevent any such condition from existing.

Table IV. Mitigation Chart				
Common Name	Scientific Name	Rating	Mid Point	% Mitigation
CATEGORY I: MITIGATE AT 100%				

Flowering dogwood	Cornus florida	90-100	95	100
Foster's, Savannah holly	Ilex x attenuata	90-100	95	100
Longleaf pine	Pinus palustris	90-100	95	100
White oak	Quercus alba	90-100	95	100
Live oak	Quercus virginiana	90-100	95	100
Crape myrtle	Lagerstroemia indica	80-100	90	100
Red maple	Acer rubrum	80-90	85	100
River birch	Betula nigra	80-90	85	100
Ginkgo	Ginkgo biloba	80-90	85	100
Loblolly bay	Gordonia lasianthus	80-90	85	100
American holly	Ilex opaca	80-90	85	100
Yaupon holly	Ilex vomitoria	80-90	85	100
Tulip or yellow poplar	Liriodendron tulipifera	80-90	85	100
Southern magnolia	Magnolia grandiflora	80-90	85	100

Sweetbay	Magnolia virginiana	80-90	85	100
Blackgum	Nyssa sylvatica	80-90	85	100
Sourwood	Oxydendrum arboreum	80-90	85	100
Southern red oak	Quercus falcata	80-90	85	100
Laurel oak	Quercus laurifolia	80-90	85	100
Water oak	Quercus nigra	80-90	85	100
Willow oak	Quercus phellos	80-90	85	100
Swamp chestnut oak	Quercus prinus	80-90	85	100
Shumard oak	Quercus shumardii	80-90	85	100
Bald cypress	Taxodium distichum	80-90	85	100
Japanese zelkova	Zelkova serrata	80-90	85	100
CATEGORY II: MITIGATE AT 75%				
Amur maple	Acer ginnala	70-80	75	75
Hickory	Carya sp.	70-80	75	75

Pecan	Carya illinoensis	70-80	75	75
Deodar cedar	Cedrus deodara	70-80	75	75
Lebanon cedar	cedrus libani	70-80	75	75
Sugarberry	Celtis laevigata	70-80	75	75
Fringetree-flowering	Chionanthus sp.	70-80	75	75
Kousa dogwood	Cornus kousa	70-80	75	75
Loquat	Eriobotrya japonica	70-80	75	75
Green or red ash	Fraxinus pennsylvanica	70-80	75	75
Eastern red cedar	Juniperus virginiana	70-80	75	75
Golden raintree	Koelreuteria paniculata	70-80	75	75
Sweetgum	Liquidambar styraciflua	70-80	75	75
Saucer magnolia	Magnolia x soulangiana	70-80	75	75
London planetree	Platanus acerifolia	70-80	75	75
Japanese (Kwansan)	Cherry Prunus serrulata	70-80	75	75

Yoshino cherry	Prunus x yedoensis	70-80	75	75
Sawtooth oak	Quercus acutissima	70-80	75	75
Sassafras	Sassafras albidum	70-80	75	75
Chinese or lacebark elm	Ulmus parvifolia	70-80	75	75
American redbud-flowering	Cercis canadensis	60-80	70	75
Hawthorn sp.-flowering	Crataegus sp.	60-80	70	75
American beech	Fagus grandifolia	60-80	70	75
Black walnut	Juglans nigra	60-80	70	75
American sycamore	Platanus occidentalis	60-80	70	75
Littleleaf linden	Tilia cordata	60-80	70	75
CATEGORY III: MITIGATE AT 50%				
Southern sugar maple	Acer barbatum	60-70	65	50

Trident maple	Acer Bbuergeranum	60-70	65	50
Hedge maple	Acer campsestre	60-70	65	50
Japanese maple	Acer palmatum	60-70	65	50
Japanese cryptomeria	Cryptomeria japonica	60-70	65	50
Chinafir	Cunninghamia lanceolata	60-70	65	50
Common persimmon	Diospyros virginiana	60-70	65	50
Franklinia	Franklinia alatamaha	60-70	65	50
Scarlet oak	Quercus coccinea	60-70	65	50
Post oak	Quercus stellata	60-70	65	50
American linden	Tilia americana	60-70	65	50
American elm	Ulmus americana	60-70	65	50
Carolina silverbell	Halesia carolina	50-60	55	50
Loblolly pine	Pinus taeda	50-60	55	50
Carolina cherrylaurel	Prunus caroliniana	50-60	55	50

Black cherry	Prunus serotina	50-60	55	50
Pin oak	Quercus palustris	50-60	55	50
Stewartia	Stewartia sp.	50-60	55	50
Snowbell	Styrax sp.	50-60	55	50
CATEGORY IV: MITIGATION AT 25%				
Silver maple	Acer saccharinum	40-50	45	25
Sugar maple	Acer saccharum	40-50	45	25
Mimosa	Albizia julibrissin	40-50	45	25
Catalpa	Catalpa sp.	40-50	45	25
Carolina ash	Fraxinum caroliniana	40-50	45	25
Honeylocust	Gleditsia triacanthos	40-50	45	25
Crabapple, apple	Malus sp.	40-50	45	25
Mulberry	Morus sp.	40-50	45	25
Virginia pine	Pinus virginiana	40-50	45	25
Poplar	Populus sp.	40-50	45	25

Chokecherry	Prunus virginiana	40-50	45	25
Flowering pear	Pyrus calleryana	40-50	45	25
English oak	Quercus robur	40-50	45	25
Willow	Salix sp.	40-50	45	25
Palms		40-50	45	25

(Ord. No. O-2008-25, 4-8-08)

Secs. 18-521—18-525. - Reserved.

Appendix N

City of Wilmington Tree Removal Permit

Department of Planning and Development
Phone: 910 254-0900 |Fax: 910 341-3264
Dial 711 TTY/Voice
929 N Front Street |PO Box 1810

APPROVED: _____ DENIED: _____ PERMIT #:_____

Application for Tree Removal from Private Property

Name of Applicant: _____ Phone: _____ Date: _____

Name of Property Owner: _____Phone: _____

Property Owner Address:_____

Email address for permit to be sent:_____

Address of Proposed Tree Removal: _____

Description and location of tree(s) to be removed & reason for removal (provide attachment if necessary and tag tree(s) on site):

1. **_____**
2. **_____**
3. **_____**

Description of replacement trees:

_____

I, _____, certify that the property owner has given me permission to apply for this permit on his/her behalf.

Applicant Signature: _____ Date: _____

FOR OFFICIAL USE ONLY***********************

Reviewed by: _____ Date_____

Remarks: _____

ALL WORK MUST BE IN COMPLIANCE WITH THE CITY LAND DEVELOPMENT CODE, Section 18-317

NEW CONSTRUCTION: ____ EXPANSION: ____ OTHER: ____ PAID: _____

Tree preservation permit fees

Less than 1 acre	**$25.00**
1-5 acres	**$50.00**
5-10 acres	**$100.00**
Greater than 10 acres	**$150.00**

******IF MITIGATION IS REQUIRED, CONTACT THE ZONING DEPARTMENT AT (910) 254-0900 TO DISCUSS A PLANTING SCHEDULE******

Application can be mailed, emailed to: zoning@wilmingtonnc.gov or dropped off at our office. No tree removal shall occur until permit application has been reviewed and approved by City Staff. Failure to comply shall result in enforcement action, including civil penalties.

Appendix O

New Hanover County Unified Development Ordinance
Article 8. Erosion and Sedimentation Control

Article 8: Erosion and Sedimentation Control

[11-16-2020]

Section 8.1. Title

This Article may be cited as the “New Hanover County Soil Erosion and Sedimentation Control Ordinance.”

Section 8.2. Purposes

This Article is adopted for the purposes of:

A. Regulating certain land-disturbing activity to control accelerated erosion and sedimentation in order to prevent the pollution of water and other damage to lakes, watercourses, and other public and private property by sedimentation; and

B. Establishing procedures through which these purposes can be fulfilled.

Section 8.3. Definitions

ACCELERATED EROSION
Any increase over the rate of natural erosion as a result of land-disturbing activity.

ACT
The Sedimentation Pollution Control Act of 1973 in G.S. 113A-50, et seq. and all rules and orders adopted pursuant to it.

ADEQUATE EROSION CONTROL DEVICES, OR STRUCTURES
Erosion control devices or structures that control the soil material within the land area under responsible control of the person conducting the land-disturbing activity.

AFFILIATE
A person that directly, or indirectly through one or more intermediaries, controls, is controlled by, or is under common control of another person.

APPROVING AUTHORITY
The Division or other State or a Local Government agency that has been delegated erosion and sedimentation Plan review responsibilities in accordance with the provisions of the Act.

BEING CONDUCTED
A land-disturbing activity has been initiated and not deemed complete by the approving authority.

BORROW
Fill material that is required for on-site construction and is obtained from other locations.

BUFFER ZONE
The strip of land adjacent to a lake or natural watercourse.

COASTAL COUNTIES
The following counties: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell, and Washington.

COMMISSION
The North Carolina Sedimentation Control Commission.

COMMON PLAN OF DEVELOPMENT
A contiguous area where multiple separate and distinct land-disturbing activities may be taking place at different times and on different schedules under one common plan. The "Common Plan" of development or sale indicates construction activities are planned to occur on a specific plot regardless of ownership of the parcels.

COMPLETION OF CONSTRUCTION OR DEVELOPMENT
No further land-disturbing activity is required on a phase of a project except that which, as determined by the approving authority, is necessary for establishing a permanent ground cover.

DEPARTMENT
The North Carolina Department of Environmental Quality.

DIRECTOR
The Director of the Division of Energy, Mineral, and Land Resources of the N.C. Department of Environmental Quality.

DISCHARGE POINT
That point at which stormwater runoff leaves a tract of land where a land-disturbing activity has occurred or enters a lake or natural watercourse.

DISTRICT
The New Hanover County Soil and Water Conservation District created pursuant to Chapter 139, North Carolina General Statutes.

DIVISION OR DEMLR
The Division of Energy, Mineral, and Land Resources of the Department of Environmental Quality.

ENERGY DISSIPATER
A structure or a shaped channel section with mechanical armoring placed at the outlet of pipes or conduits to receive and break down the energy from high velocity flow.

EROSION
The wearing away of land surfaces by the action of wind, water, gravity, or any combination thereof.

GROUND COVER
Any natural vegetative growth or other material that renders the soil surface stable against accelerated erosion.

HIGH QUALITY WATER
Those described in 15A NCAC 02B .0224, which is incorporated by reference to include subsequent amendments and editions.

HIGH QUALITY WATER (HQW) ZONES
Areas in the Coastal Counties that are within 575 feet of High Quality Waters, and for the remainder of the State, areas that are within one mile of and draining to HQW's

LAKE OR NATURAL WATERCOURSE
Any stream, river, brook, swamp, sound, bay, creek, run, branch, canal, waterway, estuary, and any reservoir, lake or pond.

LAND-DISTURBING ACTIVITY
Any use of the land by any person in residential, industrial, educational, institutional, or commercial development, highway or road construction and maintenance that results in a change in the natural cover or topography and that may cause or contribute to sedimentation.

LOCAL GOVERNMENT
Any County, incorporated village, town, or city, or any combination of counties, incorporated villages, towns, and cities, acting through a joint program pursuant to the provisions of the Act.

NATURAL EROSION
Any wearing away of the earth's surface by water, wind, or other natural agents under natural environmental conditions undisturbed by man as defined in G.S. 113A-52(5).

PARENT
An affiliate that directly, or indirectly through one or more intermediaries, controls another person.

PERSON
Any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private, institution, utility, cooperative, interstate body, or other legal entity.

PERSON CONDUCTING LAND-DISTURBING ACTIVITY
Any person who may be held responsible for a violation unless expressly provided otherwise by this Ordinance, the Act, or any order adopted pursuant to this Ordinance or the Act.

PERSON RESPONSIBLE FOR THE VIOLATION

A. The developer or other person who has or holds himself out as having financial or operational control over the land-disturbing activity; or

B. The landowner or person in possession or control of the land that has directly or indirectly allowed the land-disturbing activity, or has benefited from it or failed to comply with a duty imposed by any provision of this Ordinance, the Act, or any order adopted pursuant to this Ordinance or the Act.

PERSON WHO VIOLATES OR VIOLATOR
Any land owner or other person who has financial or operational control over the land-disturbing activity; or who has directly or indirectly allowed the activity, and who has failed to comply with any provision of the Act, or Ordinance adopted pursuant to the Act, as it imposes a duty upon that person as used in G.S. 113A-64.

PLAN
An erosion and sedimentation control Plan.

SECRETARY
The Secretary of Environmental Quality.

SEDIMENT
Solid particulate matter, both mineral and organic, that has been or is being transported by water, air, gravity, or ice from its site of origin.

SEDIMENTATION
The process by which sediment resulting from accelerated erosion has been or is being transported off the site of the land-disturbing activity or into a lake or natural watercourse.

SILTATION
Sediment resulting from accelerated erosion which is settleable or removable by properly designed, constructed and maintained control measures; and which has been transported from its point of origin within the site of a land-disturbing activity; and which has been deposited, or is in suspension in water.

STORM DRAINAGE FACILITIES
The system of inlets, conduits, channels, ditches, and appurtenances that serve to collect and convey stormwater through and from a given drainage area.

STORMWATER RUNOFF
The surface flow of water resulting from precipitation in any form and occurring immediately after rainfall or melting.

SUBSIDIARY
An affiliate that is, directly or indirectly through one or more intermediaries, controlled by another person.

TEN-YEAR STORM
A rainfall of an intensity that is based on historical data, is predicted, by a method acceptable to the approving authority, to be equaled or exceeded, on the average, once in 10 years, and of a duration that will produce a maximum peak rate of runoff from the watershed of interest under average antecedent wetness conditions.

TRACT
All continuous land and bodies of water being disturbed or to be disturbed as a unit, regardless of ownership.

TWENTY-FIVE YEAR STORM OR Q25
A rainfall of an intensity that, based on historical data is predicted, by a method acceptable to the approving authority to be equaled or exceeded, on the average, one in 25 years, and of a duration that will produce the maximum peak rate of runoff, from the watershed of interest under average antecedent wetness conditions.

UNCOVERED
The removal of ground cover from, on, or above, the soil surface.

UNDERTAKEN
The initiating of any activity, or phase of activity, that results or will result in a change in the ground cover or topography of a tract of land.

VELOCITY
The speed of flow through a cross-section perpendicular to the direction of the main channel at peak flow of the storm of interest but not exceeding bank full flows.

WASTE
Surplus materials resulting from on-site land-disturbing activities, to be disposed of offsite.

WORKING DAYS
Days exclusive of Saturday and Sunday and Federal and State holidays unless work is being conducted on these holidays, during which weather conditions or soil conditions permit land-disturbing activity to be undertaken.

Section 8.4. Scope and Exclusions

A. This Ordinance shall apply to land-disturbing activities within the following territorial jurisdiction of New Hanover County and to the extraterritorial jurisdiction of New Hanover County as allowed by agreement between local governments, the extent of annexation or other appropriate legal instrument or law.

B. Notwithstanding the general applicability of this Ordinance to all land-disturbing activity, this Article shall not apply to the following types of land-disturbing activity:

1. Including the production and activities relating or incidental to the production of crops, grains, fruits, vegetables, ornamental and flowering plants, dairy, livestock, poultry, and all other forms of agriculture undertaken on agricultural land for the production of plants and animals useful to man, including, but not limited to:

a. Forage and sod crops, grain and feed crops, tobacco, cotton and peanuts;

b. Dairy animals and dairy products;

c. Poultry and poultry products;

d. Livestock, including beef cattle, llamas, sheep, swine, horses, ponies, mules and goats, including the breeding and grazing of any or all such animals;

e. Bees and apiary products;

f. Fur producing animals;

g. Mulch, ornamental plants, and other horticultural projects. For purposes of this section, “mulch” means substances composed primarily of plant remains or mixtures of such substances.

2. An activity undertaken on forestland for the production and harvesting of timber and timber products and conducted in accordance with standards defined by the Forest Practice Guidelines Related to Water Quality (Best Management Practices), as adopted by the North Carolina Department of Agriculture and Consumer Services. If land-disturbing activity undertaken on forestland for the production and harvesting of timber and timber products is not conducted in accordance with standards defined by the Forest Practice Guidelines Related to Water Quality, the provisions of this Ordinance shall apply to such activity and any related land-disturbing activity on the tract.

3. An activity for which a permit is required under the Mining Act of 1971; Article 7 of Chapter 74 of the General Statutes;

4. A land-disturbing activity over which the State has exclusive regulatory jurisdiction and provided in G.S. 113A-56(a).

5. An activity which is essential to protect human life during an emergency;

6. Activities undertaken to restore the wetland functions of converted wetlands to provide compensatory mitigations to offset impacts permitted under Section 404 of the Clean Water Act and;

7. Activities undertaken pursuant to National Resources Conservation Service Standards to restore the wetland functions of a converted wetland defined in Title 7 Code of Federal Regulations § 12.2.

Section 8.5. General Requirements

A. Plan Approval Required: No person shall undertake any land-disturbing activity subject to this Ordinance that uncovers an acre, or more than one acre, without first having an erosion control Plan approved by the County. No land-disturbing activity may be initiated until the County is notified of the date that the land-disturbing activity will begin.

B. Protection of Property: Persons conducting land-disturbing activity shall take measures to protect all public and private property from damage caused by sedimentation and erosion damage caused by land-disturbing activities.

C. More Restrictive Rules Shall Apply: Whenever conflicts exist between Federal, State, or local laws, Ordinance, or rules, the more restrictive provision shall apply.

D. Plan Approval Exceptions: Notwithstanding the general requirement to obtain a Plan approval prior to undertaking land-disturbing activity, a Plan approval shall not be required for land-disturbing activity, that does not exceed 43,560 square feet in surface area and is not considered a part of a common plan of development. In determining the area, lands under one or diverse ownership being developed as a unit will be aggregated.

E. Building Permits: No building permit, unless excluded by Section 8.17, Permits, shall be issued without an erosion control sign-off pursuant to G.S. 153A-357 and G.S. 160A-417 as amended.

F. Inspections: Any and all applicable intermediate inspections may be held in any trade (building, mechanical, electric, and/or plumbing) if any land-disturbing activity, on a tract, including single family residences, is found not to be in compliance with any part of this Ordinance.

G. Building Finals: Building finals and/or certificates of occupancy may not be issued if any land-disturbing activity, including single-family residences, is found not to be in compliance with any part of this Ordinance.

Section 8.6. Basic Control Objectives

A. An erosion and sedimentation control Plan may be disapproved pursuant to Section 8.18, Erosion and Sedimentation Control Plans, if the Plan fails to address the following control objectives:

1. **Identify critical areas:** On-site areas which are subject to accelerated erosion, and off-site areas vulnerable to damage from erosion and/or sedimentation are to be identified and receive special attention.
2. **Limit time of exposure:** All land-disturbing activity is to be planned and conducted to limit exposure to the shortest feasible time specified in G.S. 113A-57 or as directed by the approving authority.
3. **Limit exposed area:** All land-disturbing activity is to be planned and conducted to minimize the size of the area to be exposed at any one time.
4. **Control surface water:** Surface water runoff originating upgrade of exposed areas should be controlled to reduce erosion and sediment loss during the period of exposure.

5. **Control sedimentation:** All land-disturbing activity is to be planned and conducted so as to prevent off-site sedimentation damage.
6. **Manage stormwater runoff:** Plans shall be designed so that any increase in velocity of stormwater runoff resulting from a land-disturbing activity will not result in accelerated erosion of the receiving stormwater conveyance or at the point of discharge. Plans shall include measures to prevent accelerated erosion within the project boundary and at the point of discharge.

B. Preconstruction conferences are optional. In the event, a preconstruction conference is required, it must be included on the plan.

C. No person may initiate a land-disturbing activity before notifying the County of the date that land-disturbing activity will begin and when the initial erosion control measures are installed.

D. A Plan approval issued under this Ordinance shall be prominently displayed at either the primary entrance of the job site or at another location that is observable to the public and inspectors until all construction is complete, all permanent sedimentation and erosion control measures are installed, and the site has been stabilized. A paper copy of the approved Plan shall be kept on file at the job site.

Section 8.7. Mandatory Standards for Land-Disturbing Activity

No land-disturbing activity subject to the control of this Ordinance shall be undertaken except in accordance with G.S. 113A-57 and the following mandatory standards:

A. Buffer Zone:

1. No land-disturbing activity during periods of construction or improvement to land shall be permitted in proximity to a lake or natural watercourse unless a buffer zone is provided along the margin of the watercourse of sufficient width to confine visible siltation within 25% of the buffer zone nearest the land-disturbing activity. This subdivision shall not apply to a land-disturbing activity in connection with the construction of facilities to be located on, over, or under a lake or natural watercourse.
2. The width of a buffer zone shall be measured horizontally from the edge of the water to the nearest edge of the disturbed area, with the 25% of the strip nearest the land-disturbing activity containing natural or artificial means of confining visible siltation.

B. Graded Slopes and Fills: The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion control devices or structures. The angle for graded slopes and fills must be demonstrated to be stable. Stable is the condition where the soil remains in its original configuration, with or without mechanical restraints. In any event, slopes left exposed shall, within 21 calendar days of completion of any phase of grading, be planted or otherwise provided with temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

C. Fill Material: Unless a permit from the Department's Division of Waste Management to operate a landfill is on file for the official site, acceptable fill material shall be free of organic or other degradable materials, masonry, concrete and brick in sizes exceeding

12 inches, and any materials which would cause the site to be regulated as a landfill by the State of North Carolina.

D. Ground Cover: Whenever land-disturbing activity that will disturb one or more than one acre is undertaken on a tract, the person conducting the land-disturbing activity shall install such sedimentation and erosion control devices and practices that are sufficient to retain the sediment generated by the land-disturbing activity within the boundaries of the tract during construction upon and development of said tract, and shall plant or otherwise provide a permanent ground cover sufficient to restrain erosion after completion of construction or development. Except as provided in Section 8.8.B.5 of this Ordinance, provisions for a ground cover sufficient to restrain erosion must be accomplished within 90 calendar days following completion of construction or development.

E. Prior Plan Approval: No person shall initiate any land-disturbing activity that will disturb one or more than one acre on a tract unless, 30 or more days prior to initiating the activity, an erosion and sedimentation control Plan for the activity has been both filed with and approved by the County pursuant to G.S. 113A-57(4) and G.S. 113A-54(d)(4). The land-disturbing activity shall be conducted in accordance with the approved Plan once the Plan has been approved.

F. All individuals that obtain a locally-approved erosion and sedimentation control plan that disturbs one acre or more of land, are required by the U.S. Environmental Protection Agency to obtain coverage under the N. C. Department of Environmental Quality Construction General Permit No. NCG010000 (NCG01). The requirements in NCG01 for temporary or permanent ground cover, or stabilization requirements, may differ from the ground cover, or stabilization, requirement in this Ordinance. It is the responsibility of the person conducting the land-disturbing activity to ensure compliance with the NCG01.

Section 8.8. Design and Performance Standards

A. Except provided in Subsection B.2 of this Section, erosion and sedimentation control devices and structures shall be planned, designed and constructed as to provide protection from the calculated maximum peak rate of runoff from the 10-year storm that produces the maximum peak rate of runoff as calculated according to procedures in the United States Department of Agriculture, Natural Resources Conservation Services “National Engineering Field Handbook 630 for Conservation Practices”.

B. In High Quality Water (HQW) zones, the following design standards shall apply:

1. Uncovered areas in HQW zones shall be limited at any time to a maximum total area of 20 acres within the boundaries of the tract. Only the portion of the land-disturbing activity within a HQW zone shall be governed by this section. Larger areas may be uncovered within the boundaries of the tract with the written approval of the Director upon providing engineering justification with a construction sequence that considers phasing, limiting exposure, weekly submitted self-inspection reports, and more conservative design than the 25-year storm. The Director may also stipulate the inclusion of other conditions in the plan as necessary, based on specific site conditions.

2. Erosion and sedimentation control devices, and structures within HQW zones shall be so planned, designed, and constructed to provide protection from the runoff of the 25-year storm that produces the maximum peak rate of runoff as calculated according to procedures in the United States Department of

Agriculture, National Resources Conservation Services “National Engineering Field Handbook 630 for Conservation Practices”. Other methodologies may be used if based on generally accepted engineering standards that are shown to the County to be equivalent to or improved over the procedures in Handbook 630. The County shall determine acceptability of an alternative methodology based upon a showing that the runoff model was based on observed data in agreement with the predictive model.

3. In order to provide for water quality protection in the HQW zones, sediment basins that discharge to those areas shall be designed and constructed to meet the following criteria:
    a. Use a surface withdrawal mechanism, except when the basin area is less than 1 acre;
    b. Have a minimum of 1,800 cubic feet of storage area per acre of disturbed area;
    c. Have a minimum surface area of 325 square feet per cfs of Q25 peak inflow;
    d. Have a minimum dewatering time of 48 hours; and
    e. Incorporate 3 baffles, unless the basin is less than 20 feet in length, in which case 2 baffles shall be sufficient.
4. Newly constructed open channels in HQW zones shall be designed and constructed with side slopes no steeper than two horizontals to one vertical if a vegetative cover is used for stabilization, unless soil conditions permit a steeper slope or where the slopes are stabilized by using mechanical devices, structural devices, or other forms of ditch liners proven to the County as being effective in restraining accelerated erosion. The angle for side slopes shall be sufficient to restrain accelerated erosion.
5. Upon a written request of the applicant, the Director may allow alternative design or control measures in lieu of meeting the conditions required in Subparagraph 3(b) through 3(e) of this Section if the applicant demonstrates that meeting all of those conditions will result in design or operational hardships and that the alternative measures will provide an equal or more effective level of erosion and sedimentation control on the site. Alternative measures may include, quicker applications of ground cover, use of sediment flocculants, and use of enhanced ground cover practices.

Section 8.9. Stormwater Outlet Protection

A. **Intent:** Stream banks and channels downstream from any land-disturbing activity shall be protected from increased degradation by accelerated erosion caused by increased velocity of runoff from the land-disturbing activity.

B. **Performance Standards:** Persons shall provide a design and conduct land-disturbing activity so that the post-construction velocity of the 10-year storm runoff in the receiving watercourse to, and including the discharge point, does not exceed the greater of:
    1. The velocity established by the Maximum Permissible Velocities table in subsection E of this section; or

2. The projected velocity of the 10-year stormwater runoff in the receiving stormwater conveyance prior to development.

C. Acceptable Management Measures: Measures applied alone or in combination to satisfy the intent of this section are acceptable, if there are no objectionable secondary consequences. The County recognizes that the management of storm- water runoff to minimize or control downstream channel and bank erosion is a developing technology. Innovative techniques and ideas will be considered and may be used when shown to have the potential to produce successful results. Some alternatives, while not exhaustive, are to:

1. Avoid increases in stormwater discharge velocities by designing measures to promote infiltration to compensate for increased runoff from areas rendered impervious; or
2. Avoid increases in stormwater discharge velocities by using vegetated or roughened swales and waterways in place of closed drains and high-velocity paved sections; or
3. Provide energy dissipaters at outlets of storm drainage facilities to reduce flow velocities to the point of discharge; These may range from simple rip-rapped sections to complex structures; or
4. Protect stormwater conveyance subject to accelerated erosion by improving cross sections or providing erosion-resistant lining; and
5. Upgrade or replace the receiving device structure, or stormwater conveyance such that it will receive and conduct the flow to a point where it is no longer subject to degradation from the increased rate of flow or increased velocity;

D. Exceptions: This rule shall not apply where it can be demonstrated to the County that stormwater discharge velocities will not result in accelerated erosion in the receiving stormwater conveyance or discharge point.

E. Maximum Permissible Velocities: The following is a table for maximum permissible velocity for storm water discharges in feet per second (F.P.S.) and meters per second (M.P.S.):

Table 8.9.E: Maximum Permissible Velocities

Material	F.P.S.	M.P.S.
Fine sand (non-colloidal)	2.5	0.8
Sandy loam (non-colloidal)	2.5	0.8
Silt loam (non-colloidal)	3.0	0.9
Ordinary firm loam	3.5	1.1
Fine gravel	5.0	1.5
Stiff clay (very colloidal)	5.0	1.5
Graded, loam to cobbles (non-colloidal)	5.0	1.5
Graded, silt to cobbles (colloidal)	5.5	1.7
Alluvial silts (non-colloidal)	3.5	1.1
Alluvial silts (colloidal)	5.0	1.5
Course gravel (non-colloidal)	6.0	1.8
Cobbles and shingles	5.5	1.7
Shales and hard pans	6.0	1.8

Table 8.9.E: Maximum Permissible Velocities		
Material	**F.P.S.**	**M.P.S.**
Source: Adapted from recommendations by Special Committee on Irrigation Research, American Society of Civil Engineers, 1926, for channels with straight alignment. For sinuous channels, multiply allowable velocity by 0.95 for slightly sinuous, by 0.9 for moderately sinuous channels, and by 0.8 for highly sinuous channels.		

Section 8.10. Borrow and Waste Areas

When the person conducting the land-disturbing activity is also the person conducting the borrow or waste disposal activity, areas from which borrow is obtained and which are not regulated by the provisions of the Mining Act of 1971; Article 7 of Chapter 74 of the General Statutes, and waste areas for surplus materials other than landfills regulated by the Department's Division of Waste Management shall be considered as part of the land-disturbing activity. When the person conducting the land-disturbing activity is not the person obtaining the borrow and/or disposing of the waste, these areas shall be considered a separate land-disturbing activity.

Section 8.11. Access and Haul Roads

Temporary access and haul roads, other than public roads, constructed or used in connection with any land-disturbing activity shall be considered a part of such activity.

Section 8.12. Operations in Lakes, Natural Watercourses

Land-disturbing activity in connection with construction in, on, over or under a lake or natural watercourse shall be planned and conducted in such a manner as to minimize the extent and duration of disruption of the stream channel. Where relocation of a stream forms an essential part of the proposed activity, the relocation shall minimize changes in the stream flow characteristic.

Section 8.13. Responsibility for Maintenance

During the development of a site, the person conducting the land-disturbing activity shall install and maintain all temporary and permanent erosion and sedimentation control measures as required by the approved plan, or any provision of this Ordinance, the Act, or any order adopted pursuant to the Ordinance or the Act. After site development, the land owner or person in possession or control of the land shall install and/or maintain all necessary permanent erosion and sediment control measures, except those measures installed within a road or street right-of-way or easement, accepted for maintenance by a governmental agency.

Section 8.14. Restoration of Areas Affected by Failure to Comply

The County may require a person who engaged in a land-disturbing activity and failed to retain sediment generated by the activity, as required by G.S. 113A-57(3), to restore the waters and land affected by the failure so as to minimize the detrimental effects of the resulting pollution by sedimentation. This authority is in addition to any other civil or criminal penalty or injunctive relief authorized under this Ordinance.

Section 8.15. Additional Measures

Whenever the County determines that accelerated erosion and sedimentation continues as a result of land-disturbing activity, despite installation of protective practices and maintenance of protective practices, the person conducting the land-disturbing activity will be required to and shall take additional protective action necessary to achieve compliance with the conditions specified in this Ordinance or the Act.

Section 8.16. Areas Not Otherwise Covered

Notwithstanding previous provisions, when it is determined that severe off-site erosion and/or sedimentation has occurred as a result of any land-disturbing activity, regardless of the size of the site, and despite application and maintenance of protective practices, remedial action shall be taken within a reasonable time period after notification. A notice shall be served upon that person by any means authorized under G.S. 1A-1 Rule 4. The notice shall specify a date by which the person must comply with the Ordinance or rules adopted by this Ordinance. Any person who fails to comply within the time specified is subject to additional civil and criminal penalties for a continuing violation as provided by this Ordinance.

Section 8.17. Permits

A. No person shall undertake any land-disturbing activity subject to this Ordinance without first obtaining a hardcopy or electronic permit from the County, except that no permit shall be required for any land-disturbing activity:

1. For the purpose of fighting fires;

2. For the stock piling of raw or processed sand, stone or gravel in material processing plants and storage yards, provided that sediment control measures have been utilized to protect against off-site damage; or

3. That does not exceed 43,560 square feet in surface area. In determining the area, lands under one or diverse ownership being developed as a unit will be aggregated. (Note: This exclusion from permits should allow land-disturbing activities for construction of a single-family residence on a single lot, but may not exceed one acre or be part of a common plan of development).

B. The County may establish a fee schedule for the review and approval of erosion control Plans. In establishing the fee schedule, the County shall consider the administrative and personnel cost incurred by the department for reviewing the Plans and for related compliance activities.

C. The permit fees as seen in Table 8.17.C include review and land disturbance fees:

Table 8.17.C: Permit Fees			
Residential			
Review	$200 New Projects (Paid at time of application)	$200 Active Projects (Adding new acreage)	$200 Previously permitted inactive projects (With modification)
Land Disturbance	$300 per acre disturbed or any increment of an acre. Due prior to Plat Recordation. Builders in a subdivision with active permits where the developer previously paid review and land-disturbing fees will not owe fees.		
Commercial			
Review	$200 New Projects (Paid at time of application)	$200 Active Projects (Adding new acreage)	$200 Previously permitted inactive projects (With modification)
Land Disturbance	$300 per acre disturbed or any increment of an acre. Due prior to issuance of a Certificate of Occupancy.		
Other			
Review	$200 (Paid at time of application)		
Land Disturbance	$300 per acre or increment of an acre. Due prior to issuance of the land-disturbing permit		

D. Permits will expire one year from the date of issue if no construction activity begins on site. If activity ceases on a permitted site for a period of 12 months, the permit will expire.

Section 8.18. Erosion and Sedimentation Control Plans

A. An erosion control Plan shall be prepared for all land-disturbing activities subject to this Ordinance whenever the proposed activity will disturb one or more than one acre on a tract. The Plan shall be filed with the County Engineering Department, the New Hanover Soil and Water Conservation District, and for areas outside municipal corporate limits, the County Planning Department, at least 30 days prior to the commencement of the proposed activity.

B. Persons conducting land-disturbing activity on a tract which covers one or more than one acres shall file three copies of the erosion control Plan or a digital copy, with the County at least 30 days prior to beginning such activity and shall keep another paper copy of the approved Plan and a posted copy of the permit prominently displayed at either the primary entrance of the job site or at another location that is observable to the public and inspectors until all construction is complete, all permanent sedimentation and erosion control measures are installed, and the site has been stabilized. After approving the Plan, if the County either upon review of such Plan or inspection of the job site, determines that the Plan is inadequate to meet the requirements of the Act and of this Ordinance, the County shall require a revised Plan. Pending the preparation of the

revised Plan, work shall cease or shall continue under conditions outlined by the appropriate authority.

C. Erosion control Plans shall be disapproved unless accompanied by an authorized statement of financial responsibility and documentation of property ownership. This statement shall be signed by the person financially responsible for the land-disturbing activity or his or her attorney-in-fact. The statement shall include the mailing and street addresses of the principle place of business of the person financially responsible, and of the owner of the land, or registered agents. If the person financially responsible is not a resident of North Carolina, a North Carolina agent must be designated in the statement for the purpose of receiving notice of compliance or noncompliance with the Plan, the Act, this Ordinance, or rules or orders adopted or issued pursuant to this Ordinance. Except as provided in subsection D and K of this section, if the applicant is not the owner of the land to be disturbed, the draft erosion and sedimentation control Plan must include the owner's notarized written consent for the applicant to submit a draft erosion and sedimentation control Plan and to conduct the anticipated land-disturbing activity.

D. If the applicant is not the owner of the land to be disturbed and the anticipated land-disturbing activity involves the construction of utility lines for the provision of water, sewer, gas, telecommunications, or electrical service, the draft erosion and sedimentation control Plan may be submitted without the written consent of the owner of the land, so long as the owner of the land had been provided prior notice of the project.

E. The New Hanover Soil and Water Conservation District and the County Planning Department within 20 days of receipt of any Plan, shall review such Plan and submit its comments and recommendations to the County Engineering Department. Failure of the Soil and Water Conservation District and the County Planning Department to submit its comments and recommendations within 20 days or within the prescribed additional time will not delay final action on the Plan.

F. The County will review each complete Plan submitted to them and within 30 days of receipt. The person submitting the Plan, will be notified that it has been approved, approved with modifications, or disapproved. The County shall condition approval of an erosion control plan upon the applicant's compliance with Federal and State Water Quality laws, regulations, and rules. The County shall also disapprove an erosion control plan if implementation of the Plan would result in a violation of rules adopted by the Environmental Management Commission to protect riparian buffers along surface waters. Failure to approve, approve with modifications, or disapprove a complete erosion and sedimentation control Plan within 30 days of receipt shall be deemed approval. Disapproval of an erosion control Plan or a revised erosion control Plan must specifically state in writing the reasons for disapproval. The County must approve, approve with modifications, or disapprove a revised Plan within 15 days of receipt, or it is deemed to be approved. If, following commencement of a land-disturbing activity pursuant to an approved Plan, the County determines that the Plan is inadequate to meet the requirements of the Act and of this Ordinance, either upon review of such Plan or inspection of the job site, the County shall require a revised Plan. Pending the preparation of the revised Plan, work shall cease or shall continue under conditions outlined by the appropriate authority. Approval with modification or disapproval of any proposed plan shall entitle the person submitting the Plan to a public hearing in accordance with the provisions of G.S. 113A-61(c).

G. Any plan submitted for a land-disturbing activity for which an environmental document is required by the North Carolina Environmental Policy G.S. 113 Article 1, and the

Department rules set forth in 15A NCAC 01C. shall be deemed incomplete until a complete environmental document is available for review. The County shall notify the person submitting the Plan that the 30-day time limit for review of the Plan pursuant to subsection F of this Section shall not begin until the environmental document is available for review.

H. The County shall approve a Plan upon determining that it complies with all applicable State and local regulations for erosion and sedimentation control. The County shall condition approval of Plans upon the applicant's compliance with the Federal and State water quality laws, regulations and rules. Approval assumes the applicant's compliance with the Federal and State water quality laws regulations, and rules.

I. The Plan required by this section shall contain architectural or engineering drawings, maps, assumptions, calculations, and narrative statements as needed to adequately describe the proposed development of the tract and the measures planned to comply with the requirements of this Ordinance. Plan content may vary to meet the needs of specific site requirements. Detailed guidelines for Plan preparation may be obtained from the County, on request. The Plan shall contain a schedule for inspections after each phase has been completed.

J. The County may disapprove an erosion and sedimentation control Plan or disapprove a transfer of a Plan under subsection K of this Section upon a finding that an applicant, or a parent, subsidiary, or other affiliate of the applicant:

1. Is conducting or has conducted land-disturbing activity without an approved Plan, or has received notice of violation of a Plan previously approved by the Commission or a local government pursuant to this Article and has not complied with the notice within the time specified in the notice;

2. Has failed to pay a civil penalty assessed pursuant to the Article or a local Ordinance adopted pursuant to this Article by the time the payment is due;

3. Has been convicted of a misdemeanor pursuant to G.S. 113A-64(b) or any criminal provision of a local Ordinance adopted pursuant to this Article or;

4. Has failed to substantially comply with State rules or local Ordinances and regulations adopted pursuant to this Article.

For purposes of Subsection J an applicant's record or the proposed transferee's record may be considered for only two (2) years prior to the application date.

In the event that an erosion and sedimentation control Plan or transfer of a Plan is disapproved by the county pursuant to subsection J of this Section, the County shall notify the Director of the Division of Energy, Mineral, and Land Resources of such disapproval within 10 days of the disapproval. The County shall advise the applicant or the proposed transferee and the Director in writing as to the specific reasons that the Plan was disapproved. Notwithstanding the provisions of Section 8.19.A, the applicant may appeal the local government's disapproval of the Plan directly to the Commission.

K. The County administering an erosion and sedimentation control program may transfer an erosion and sedimentation control Plan approved pursuant to this Section without the consent of the Plan holder to a successor-owner of the property on which the permitted activity is occurring or will occur as provided in this subsection.

1. The County may transfer a Plan if all the following conditions are met:

a. The successor-owner of the property submits to the local government a written request for the transfer of the Plan and an authorized statement of financial responsibility and proof of ownership:

b. The County finds all the following:

1. The Plan holder is one of the following:

i. A natural person who is diseased.

ii. A partnership, limited liability corporation, corporation, or any other business association that has been dissolved.

iii. A person who has been lawfully and finally divested of title to the property on which the permitted activity is occurring or will occur.

iv. A person who has sold the property on which the permitted activity is occurring or will occur.

2. The Plan holder shall comply with all terms and conditions of the Plan until such time as the Plan is transferred.

3. The successor-owner shall comply with all terms and conditions of the Plan once the Plan has been transferred.

4. Notwithstanding changes to law made after the original issuance of the Plan, the County may not impose new or different terms and conditions in the Plan without the prior express consent of the successor-owner. Nothing in this subsection shall prevent the County from requiring a revised Plan pursuant to G.S. 113A-54.1 (b).

L. No person may initiate a land-disturbing activity before notifying the agency that issued the Plan approval of the date that the land-disturbing activity will begin. The County shall also be notified when the initial erosion control measures are installed, if no preconstruction meeting is held. If preconstruction meetings become a requirement it must be included on the plan.

M. Applications for amendment of an erosion control Plan in written and/or graphic form may be made at any time under the same conditions as the original application. Until such time as said amendment is approved by the County, the land-disturbing activity shall not proceed except in accordance with the erosion control Plan as originally approved.

N. Any person engaged in land-disturbing activity who fails to file a Plan in accordance with the Ordinance or who conducts a land-disturbing activity except in accordance with provisions of an approved Plan shall be deemed in violation of this Ordinance.

O. All land-disturbing activities required to have an approved erosion and sedimentation control plan under G.S. 113A-54.1(e) and Sec. 8.18 (A) shall conduct self-inspections for initial installation or modification of any erosion and sedimentation control devices and practices described in an approved Plan. In addition, weekly and rain-event self-inspections are required by Federal regulations, that are implemented through the NPDES Construction General Permit No. NCG010000.

Where self-inspections are required by G.S. 113A-54.1(e) and Section 8.18.O of this Ordinance, the following apply:

1. The person who performs the inspections shall make a record of the site inspection by documenting the following items: The inspection shall be performed during or after each of the following phases of the Plan;
    a. Initial installation of the erosion and sedimentation control measures;
    b. Clearing and grubbing of existing ground cover;
    c. Completion of any grading that requires ground cover;
    d. Completion of all land-disturbing activity, construction, or development, including permanent ground cover establishment and removal of all temporary measures; and
    e. Transfer of ownership or control of the tract of land where the erosion and sedimentation control Plan has been approved and work has begun. The new owners or person in control shall conduct and document inspections until the project is permanently stabilized as set forth in Sub-Item 1(c) of this Section.
2. Documentation of self-inspections performed under Section 1 shall include:
    a. Visual verification of ground stabilization and other erosion control measures and practices as called for in the approved Plan;
    b. Verification by measurement of settling basins, temporary construction entrances, energy dissipaters, and traps;
    c. The name, address, organization affiliation, telephone number, and signature of the person conducting the inspection and the date of the inspection shall be included, whether on a copy of the approved erosion and sedimentation control Plan or an inspection report. A template for an example of an inspection and monitoring report is provided on the DEMLR website at https://deq.nc.gov/about/divisions/energy-mineral-land-resources/erosion-sediment-control/forms. Any relevant licenses and certifications may also be included. Any documentation of inspections that occur on a copy of the approved erosion and sedimentation control Plan shall occur on a single copy of the Plan and the Plan shall be made available on the site.
    d. A record of any significant deviation from any erosion or sedimentation control measure from that on the approved Plan. For the purpose of this Section, a “significant deviation” means an omission, alternation, or relocation of an erosion or sedimentation control measure that prevents it from performing as intended. The record shall include measures required to correct the significant deviation, along with documentation of when those measures were taken. Deviations from the approve Plan may also be recommended to enhance the intended performance of the sedimentation and erosion control measures.

Section 8.19. Plan Review Appeals

A. Except as provided in subsection B of this section, the appeal of a disapproval or approval with modifications of a Plan shall be governed by the following provisions:

1. The disapproval or modification of any proposed erosion control Plan by the County, shall entitle the person submitting the Plan or applying for the permit, to a public hearing if such person submits written demand for a hearing within 15 days after receipt of written notice of disapproval or modifications.
2. Hearings held pursuant to this section shall be conducted by the County Engineer within ten (10) days after the date of the appeal or request for a hearing.
3. The County Engineer shall make recommendations to the New Hanover County Board of Commissioners, within ten days (10) after the date of the hearing on any erosion control Plan.
4. The Board of Commissioners will render its final decision on any Plan upon which a hearing is requested within 30 days of conducting the hearings.
5. If the Board of Commissioners upholds the disapproval or modification of a proposed Plan following the hearing, the person submitting the Plan shall then be entitled to appeal the Board of Commissioners decision to the Commission. The Commission shall direct the Secretary to appoint employees of the Department as provided in G.S. 113A-61(c) and Title 15A NCAC 4B.0118 (d), to a Plan review committee, to hear appeals from the disapproval or modification of erosion and sedimentation control Plans by local governments. Within 30 days following receipt of notification of the appeal, department employees shall complete the review and shall notify the County and the person appealing the County decision that the Plan should be approved, approved with modifications, or disapproved.
6. If either the local government or the person submitting the Plan disagrees with the decision reached by the Department, the applicants right under G.S. 113A-54.1(d) to appeal the Director's disapproval of an erosion control Plan under G.S. 113 A-54.1(c) gives rise to a right to an appeal to the Commission by filing a notice within 15 days with the Director of the Division of Energy, Mineral, and Land Resources. A Plan review committee consisting of three members of the Commission will be appointed to review the Department's decision. Within 10 days following receipt of the notification of appeal, the Commissions erosion and sedimentation Plan review committee shall notify the local government and the person submitting the plan of a place and time for a hearing for consideration of the appeal. Both parties shall be given at least 15 days' notice of the hearing and an opportunity to present written or oral arguments. The erosion and sedimentation Plan review committee shall notify both parties of its decision concerning the approval, disapproval, or modification of the proposed Plan within 30 days following the hearing.
7. An applicant desiring to appeal the Commission's disapproval of an erosion control Plan shall file with the Office of Administrative Hearings a contested case petition under G.S. 150B, Article 3.

B. If an erosion control Plan is disapproved pursuant to Section 8.18.H, of this Ordinance. The applicant may appeal the County disapproval of the Plan directly to the State Sedimentation Control Commission.

Section 8.20. Inspections and Investigations

A. Agents, officials, or other qualified persons authorized by the County, will periodically inspect land-disturbing activity to ensure compliance with the Act, this Ordinance, or rules or orders adopted or issued pursuant to this Ordinance, and to determine whether the measures required in the Plan are effective in controlling erosion and sedimentation resulting from land-disturbing activity. Notice of the right to inspect shall be included in the notification of each Plan approval.

B. If the County determines that a person engaged in land-disturbing activity has failed to comply with the Act, this Ordinance, or rules, or orders adopted or issued pursuant to this Ordinance, or has failed to comply with an approved Plan, a notice of violation shall be served upon that person by any means authorized under in G.S. 1A-1 Rule 4 to give actual notice. The notice shall set forth the measures necessary to achieve compliance with the, Act, this Ordinance, or rules, or orders adopted or issued pursuant to this Ordinance, specify a reasonable time period within which such measures must be completed, and warn that failure to correct the violation within the time period specified in the notice of violation may result in additional civil and criminal penalties for a continuing violation as provided in G.S. 113A-64 and this Ordinance. However, no time period for compliance need be given for failure to submit an erosion control Plan for approval or for willfully obstructing, hampering or interfering with an authorized representative, while in the process of carrying out his official duties. If the person engaged in land-disturbing activity fails to comply within the time specified, enforcement action may be initiated.

C. The County shall have power to conduct such investigations as it may reasonably deem necessary to carry out its duties as prescribed in this Ordinance, and for this purpose to enter at reasonable times upon any property, public or private, for the purpose of investigating and inspecting the sites of any land-disturbing activity. No person shall refuse entry or access to any authorized representative or agent who requests entry for purposes of inspection and who presents appropriate credentials;

D. The County shall also have the power to require written statements, or the filing of reports under oath, with respect to pertinent questions relating to land-disturbing activity including self-inspections, engineering design reports, or Notices of Violation (NOVs), as necessary to carry out duties specified in the Act or this Ordinance.

Section 8.21. Penalties

A. Civil Penalties:

1. Any person who violates any of the provisions of this Ordinance, or rules or orders adopted or issued pursuant to this Ordinance, or order adopted or issued pursuant to this Ordinance, or who initiates or continues a land-disturbing activity for which a Plan is required except in accordance with the terms, conditions, and provisions of an approved Plan, shall be subject to a civil penalty. The maximum civil penalty amount that the county may assess per is five thousand dollars ($5,000.00) per calendar day. A civil penalty may be assessed from the date of the violation. Each day of a continuing violation shall constitute a separate violation. The person alleged to be in violation will be notified of the violation by any means authorized under G.S. 1A-1 Rule 4 to give actual notice. The notice shall describe the violation, state the reason for accessing the penalty, request the illegal activity cease, specify the actions to be taken, specify a reasonable

time period within which the violation must be corrected, and warn that failure to correct the violation within the time period will result in the assessment of a civil penalty or other enforcement action pursuant to G.S. 113A-64. If, after the allotted time period has expired, the violator has not completed corrective action, a civil penalty may be assessed from the date of the notice of violation. However, no time period for compliance need be given for failure to submit an erosion control Plan for approval or for obstructing, hampering or interfering with an authorized representative while in the process of carrying out his official duties. Each day of continuing violation shall constitute a separate violation. When the person has not been assessed any civil penalty under this subsection for any previous violation, and the person abated the continuing environmental damage resulting from the violation within 180 days from the date of the notice of violation, the maximum cumulative total civil penalty assessed under this subsection for all violations associated with the land-disturbing activity for which the erosion and sedimentation control Plan is required is twenty-five thousand dollars ($25,000).

2. The County Manager or his designee shall determine the amount of the civil penalty to be assessed under this subsection and shall notify the person who is assessed the civil penalty of the amount of the penalty and the reason for assessing the penalty. In determining the amount of the penalty the County Manager or his designee shall consider the severity of the violation, the type(s) of violation; the duration; the cause; the extent of any off-site damage which may have resulted; effectiveness of action taken by the violator; adherence to the Plan submitted by the violator; effectiveness of the Plan submitted by the violator; estimated cost of taking corrective sediment control actions; staff investigative cost; the amount of money the violator saved by noncompliance, whether the violation was committed willfully, and the prior record of the violator in complying or failing to comply with this Ordinance, the Commission, or the Act. The County shall provide notice of the civil penalty amount and basis for assessment to the person assessed. The notice of assessment shall be served by any means authorized under G.S. 1A-1, Rule 4. The notice of assessment shall direct the violator to either pay the civil penalty assessment, or contest the assessment within 30 days after receipt of the notice of assessment, by filing a written petition for a hearing before the Board of County Commissioners, or file a request with the Sedimentation Control Commission for remission of the assessment within 60 days of receipt of the notice. A remission request must be accompanied by a waiver of the right to a contested case hearing pursuant to Chapter 150B of the North Carolina General Statutes and a stipulation of the facts on which the assessment was based. Notice of the assessment shall be served by any means authorized under G.S.1A-1, Rule 4 to give actual notice.

3. Any appeals from the determination of the Board of County Commissioners must be filed with the Superior Court of the County within 30 days following the Board's issuance of its final determination. If payment is not received or equitable settlement reached within 60 days after demand for payment is made, the matter shall be referred to the County Attorney for institution of a civil action in the name of the County in Superior Court where the violation occurred, or the violators residence or principle place of business. A civil action must be filed within three (3) years of the date the assessment was due. An assessment that is not contested is due when the violator is served with a notice of assessment. An

assessment that is contested is due at the conclusion of the administrative and judicial review of the assessment.

4. The clear proceeds of civil penalties collected pursuant to this Ordinance shall be remitted to the Civil Penalty and Forfeiture Fund in accordance with G.S. 115C-457.2. Penalties collected by the County may be diminished only by the actual costs of collection. The collection cost percentage to be used shall be established and approved by the North Carolina Office of State Budget and Management on an annual basis, based upon the computation of actual collection cost by each County for the prior fiscal year. (In any event, the cost percentage shall not exceed twenty percent (20%) of penalties collected).

B. Criminal Penalties: Any person who knowingly or willfully violates any provision of this Ordinance, or rule or order adopted or issued pursuant to this Ordinance, or who knowingly or willfully initiates or continues a land-disturbing activity for which an erosion control Plan is required except in accordance with terms, conditions, and provisions of an approved Plan, shall be guilty of a Class 2 misdemeanor which may include a fine not to exceed five thousand dollars ($5,000.00) per calendar day as provided in G.S. 113A-64.

Section 8.22. Injunctive Relief

A. Whenever the governing body has reasonable cause to believe that any person is violating or threatening to violate this Ordinance or any rule or order adopted or issued pursuant to this Ordinance, or any term, condition, or provision of an approved Plan, it may, either before or after the institution of any other action or proceeding authorized by this Ordinance, institute a civil action in the name of the County, for injunctive relief to restrain the violation or threatened violation. The action shall be brought in the Superior Court of the County in which the violation is occurring or is threatened.

B. Upon determination by a Court that an alleged violation is occurring or is threatened, the Court shall enter any order or judgment that is necessary to abate the violation, to ensure that restoration is performed, or to prevent the threatened violation. The institution of an action for injunctive relief under this section shall not relieve any party to such proceedings from any civil or criminal penalty prescribed for violations of this Ordinance.

Section 8.23. Severability

If any section or sections of this Ordinance is/are held to be invalid or unenforceable, all other sections shall nevertheless continue in full force and effect.

Section 8.24. Effective Date

November 16, 2020

Section 8.25. Reserved

Appendix P

Aquifer Maps

LOWER CAPE FEAR
AQUIFER LIMIT

SOUTHSIDE WASTEWATER
TREATMENT PLANT PROJECT AREA

Legend

Water Level (ft above MSL)

- 80
- 60
- 40
- 20
- 0
- -20
- -40
- -60

0 10 20 40 60 80 Miles

Southside WWTP
Replacement & Capacity Upgrade

Lower Cape Fear Aquifer Map

1 in = 100,000 ft

Cape Fear Public Utility Authority

M&C No:	Date:
03385-0017	Oct 2023

McKIM&CREED

Legend

Water Level (ft above MSL)

- 110
- 100
- 90
- 80
- 70
- 60
- 50
- 40
- 30
- 20
- 10
- 0
- -10
- -20
- -30
- -40
- -50
- -60
- -70

PEE DEE AQUIFER LIMIT

SOUTHSIDE WASTEWATER TREATMENT PLANT PROJECT AREA

0 10 20 40 60 80 Miles

Source:

Southside WWTP
Replacement & Capacity Upgrade

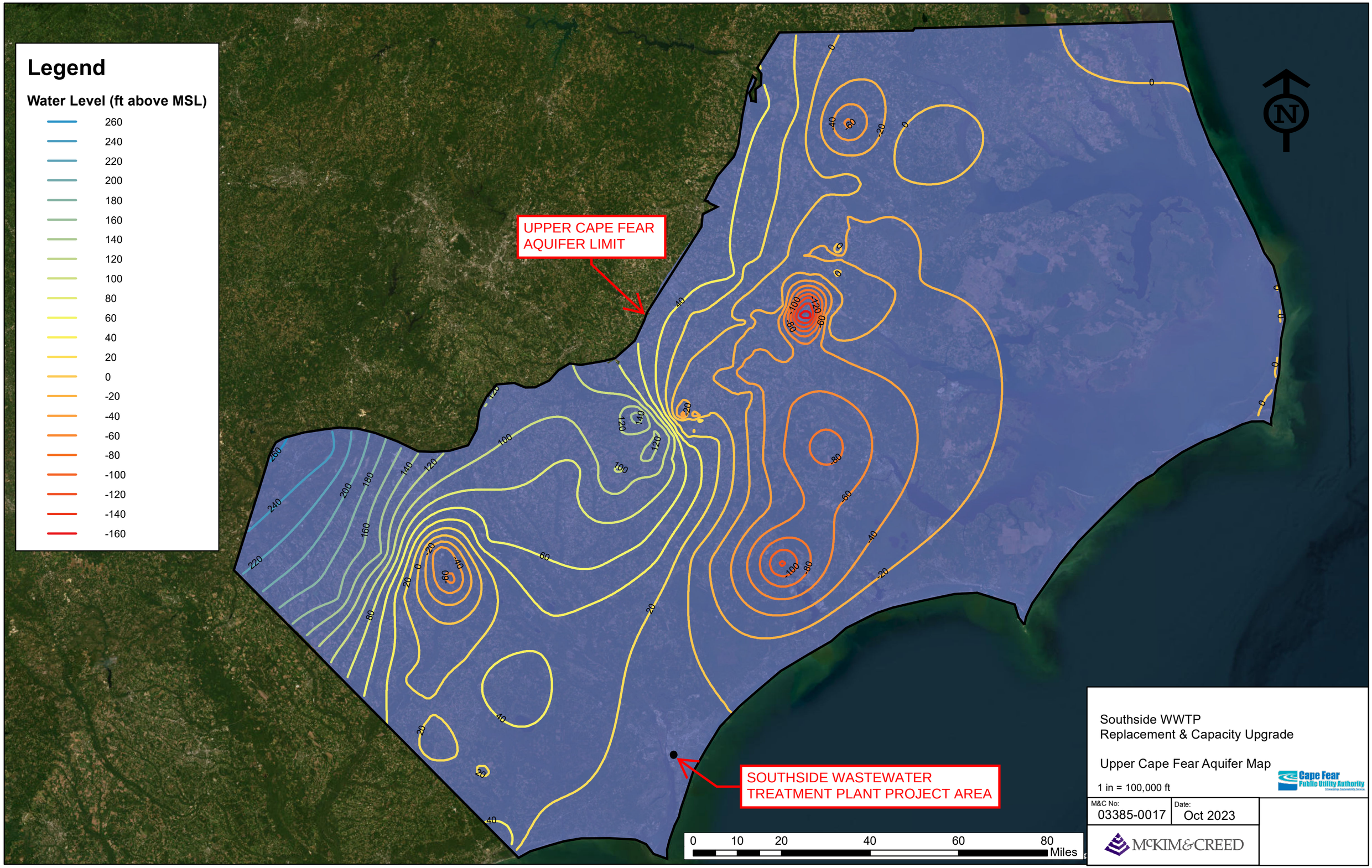
Pee Dee Aquifer Map

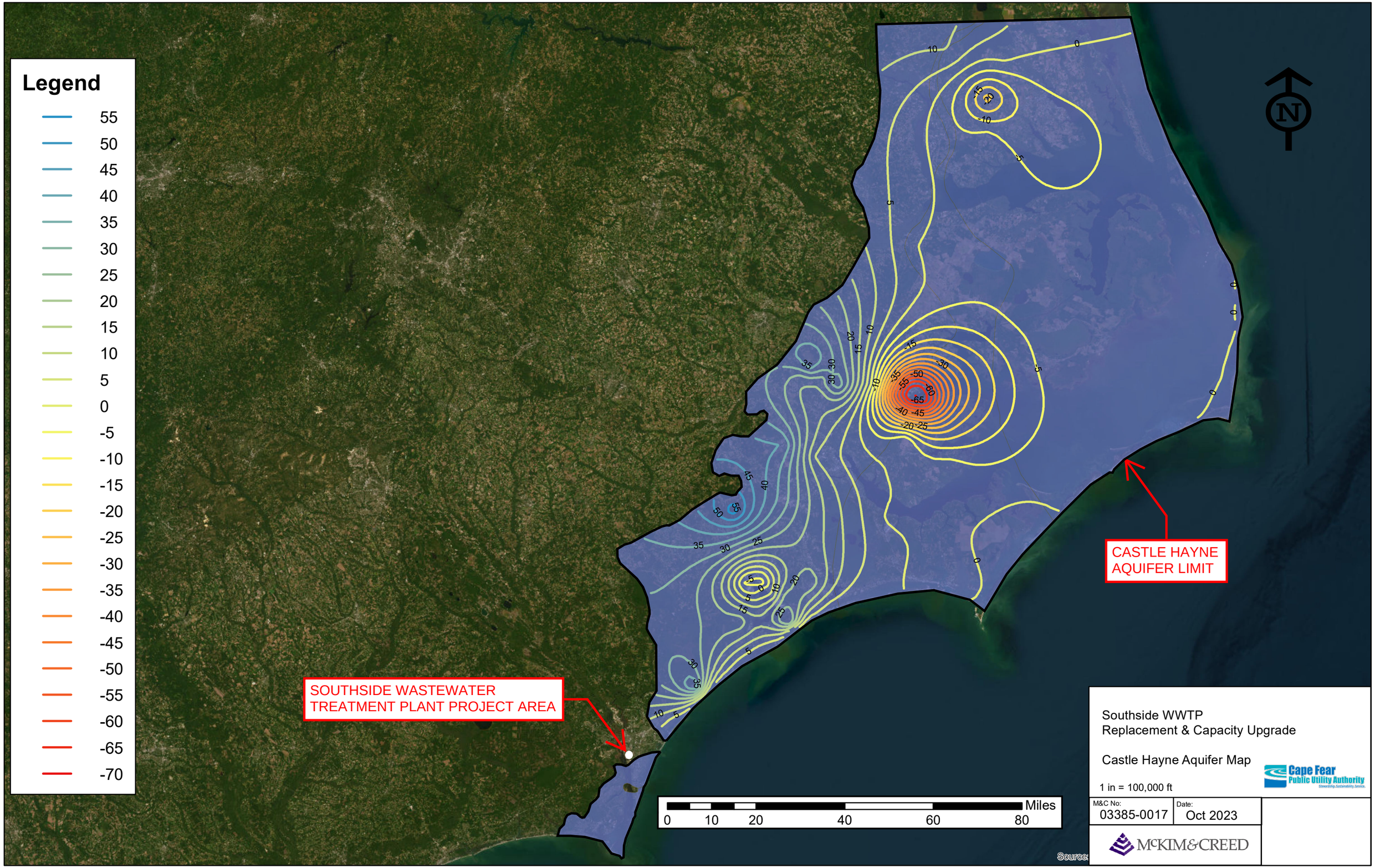
Cape Fear Public Utility Authority
Stewardship. Sustainability. Service.

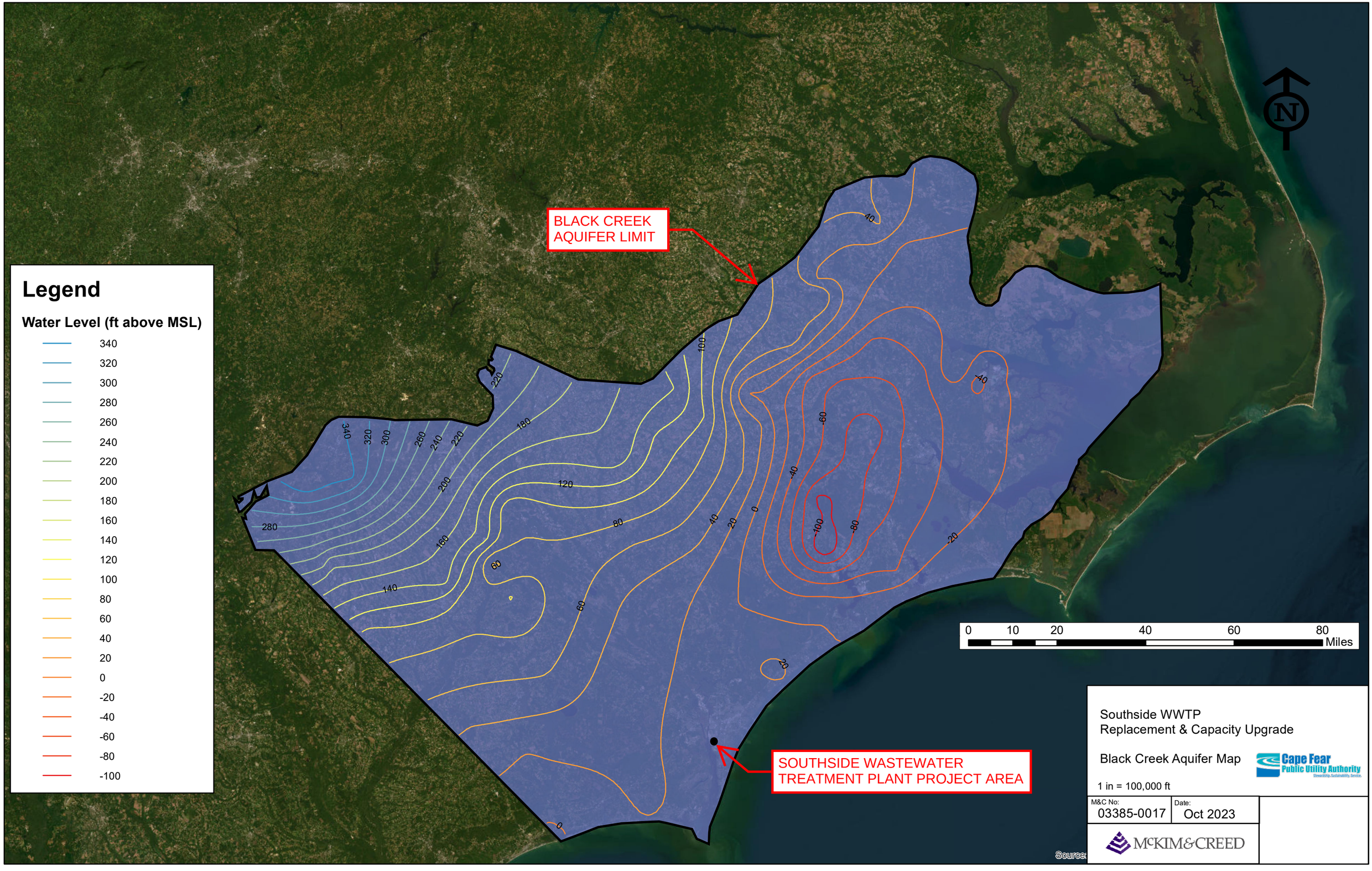
1 in = 100,000 ft

M&C No:	Date:
03385-0017	Oct 2023

McKIM&CREED


Legend
Water Level (ft above MSL)
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
UPPER CAPE FEAR AQUIFER LIMIT
SOUTHSIDE WASTEWATER TREATMENT PLANT PROJECT AREA
N
0 10 20 40 60 80
Miles
Southside WWTP
Replacement & Capacity Upgrade
Upper Cape Fear Aquifer Map
1 in = 100,000 ft
Cape Fear Public Utility Authority
M&C No: 03385-0017
Date: Oct 2023
McKIM&CREED


Legend
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
N
CASTLE HAYNE
AQUIFER LIMIT
SOUTHSIDE WASTEWATER
TREATMENT PLANT PROJECT AREA
0
10
20
40
60
80
Miles
Source:
Southside WWTP
Replacement & Capacity Upgrade
Castle Hayne Aquifer Map
1 in = 100,000 ft
M&C No:
03385-0017
Date:
Oct 2023
Cape Fear
Public Utility Authority
McKIM&CREED


BLACK CREEK
AQUIFER LIMIT
SOUTHSIDE WASTEWATER
TREATMENT PLANT PROJECT AREA
N
Legend
Water Level (ft above MSL)
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
0 10 20 40 60 80
Miles
Southside WWTP
Replacement & Capacity Upgrade
Black Creek Aquifer Map
1 in = 100,000 ft
M&C No:
03385-0017
Date:
Oct 2023
McKIM&CREED
Cape Fear
Public Utility Authority

Appendix Q

Excerpt from 2022 North Carolina 303(d) List

AU Name	AU Number	Classification	AU LengthArea	AU Units
CAPE FEAR RIVER	18-(71)a3	SC	1,274.9	S Acres

AU ID: 13732 — Description: From Greenfield Creek to Barnards Creek

2022 Water Quality Assessments

PARAMETER	IR CATEGORY	CRITERIA STATUS
Dissolved Oxygen (5 mg/l, AL, SW)	5	Exceeding Criteria
Water Temperature (32ºC, AL, LP&CP)	1	Meeting Criteria
pH (4.3 su, AL, Sw)	1	Meeting Criteria
pH (8.5, AL, SW)	1	Meeting Criteria
Chlorophyll a (40 µg/l, AL, NC)	1	Meeting Criteria
Turbidity (25 NTU, AL, FW acres & SW)	1	Meeting Criteria
Copper (3 µg/l, AL, SW)	5	Exceeding Criteria
Fecal Coliform (GM 200/400, REC, FW)	1	Meeting Criteria
Cyanide (5 mg/L, AL, FW)	3a	Data Inconclusive

AU Name	AU Number	Classification	AU LengthArea	AU Units
CAPE FEAR RIVER	18-(71)a4	SC	372.9	S Acres

AU ID: 13733 — Description: From Barnards Creek to 0.6 miles downstream of Barnards Creek

2022 Water Quality Assessments

PARAMETER	IR CATEGORY	CRITERIA STATUS
Dissolved Oxygen (5 mg/l, AL, SW)	5	Exceeding Criteria
Water Temperature (32ºC, AL, LP&CP)	1	Meeting Criteria
pH (4.3 su, AL, Sw)	1	Meeting Criteria
pH (8.5, AL, SW)	1	Meeting Criteria
Turbidity (25 NTU, AL, FW acres & SW)	1	Meeting Criteria
Fecal Coliform (GM 200/400, REC, FW)	1	Meeting Criteria

AU Name	AU Number	Classification	AU LengthArea	AU Units
CAPE FEAR RIVER	18-(71)a5	SC	2,183.7	S Acres

AU ID: 13734 — Description: From 0.6 miles downstream of Barnards Creek to 1.9 miles downstream of Mott Creek

2022 Water Quality Assessments

PARAMETER	IR CATEGORY	CRITERIA STATUS
Dissolved Oxygen (5 mg/l, AL, SW)	5	Exceeding Criteria
Water Temperature (32ºC, AL, LP&CP)	1	Meeting Criteria
pH (4.3 su, AL, Sw)	1	Meeting Criteria
pH (8.5, AL, SW)	1	Meeting Criteria
Copper (3 µg/l, AL, SW)	5	Exceeding Criteria

AU Name	AU Number	Classification	AU LengthArea	AU Units
CAPE FEAR RIVER	18-(71)a6	SC	1,394.1	S Acres

AU ID: 13735 — Description: From 1.9 miles downstream of Mott Creek to a line across the river Between Lilliput Creek and Snows Cut

2022 Water Quality Assessments

PARAMETER	IR CATEGORY	CRITERIA STATUS
Copper (3 µg/l, AL, SW)	5	Exceeding Criteria

AU Name	AU Number	Classification	AU LengthArea	AU Units
CAPE FEAR RIVER	18-(71)b	SC	7,855.1	S Acres

AU ID: 4389 — Description: From a line across the river between Lilliput Creek and Snows Cut to a line across the river from Walden Creek to the Basin

2022 Water Quality Assessments

PARAMETER	IR CATEGORY	CRITERIA STATUS
Water Temperature (32ºC, AL, LP&CP)	1	Meeting Criteria
pH (6.8 su, AL, SW)	1	Meeting Criteria
pH (8.5, AL, SW)	1	Meeting Criteria
Dissolved Oxygen (5 mg/l, AL, SW)	1	Meeting Criteria

Appendix R

CAMA Consistency Review Correspondence

APPENDIX R – CAMA CONSISTENCY REVIEW CORRESPONDENCE

Thanks Katie. If any proposed work is taking place landward of coastal and 404 wetlands and is also farther landward than 75' from high water, then it would potentially be outside CAMA jurisdiction. Any 404 wetland impacts that falls outside of CAMA jurisdiction would need to be coordinated directly with the US Army Corps of Engineers. The LMG map is dated 2021, so if the proposed work is close to what has been mentioned, it would be best to have updated lines and further review from DCM to confirm no CAMA authorization is required.

I can't speak for the local level if they have any more restrictive ordinances or CODs so I'd recommend reaching out to them as well. Let me know if you have any questions.

Thanks,

Bryan Hall
Field Representative
NC Division of Coastal Management
Department of Environmental Quality

(910) 796-7423 office
bryan.l.hall@deq.nc.gov - **Please note my new email address**

127 Cardinal Drive Ext
Wilmington, NC 28405

Find a Field Rep (arcgis.com)

Email correspondence to and from this address is subject to the North Carolina Public Records Law and may be disclosed to third parties.

From: Katie Elliott <KElliott@mckimcreed.com>
Sent: Friday, November 3, 2023 9:48 AM
To: Hall, Bryan L <Bryan.L.Hall@deq.nc.gov>
Cc: MacPherson, Tara <tara.macpherson@deq.nc.gov>
Subject: FW: [External] Consistency Review: SRF ER/EID: New Hanover County

CAUTION: External email. Do not click links or open attachments unless verified. Report suspicious emails with the Report Message button located on your Outlook menu bar on the Home tab.

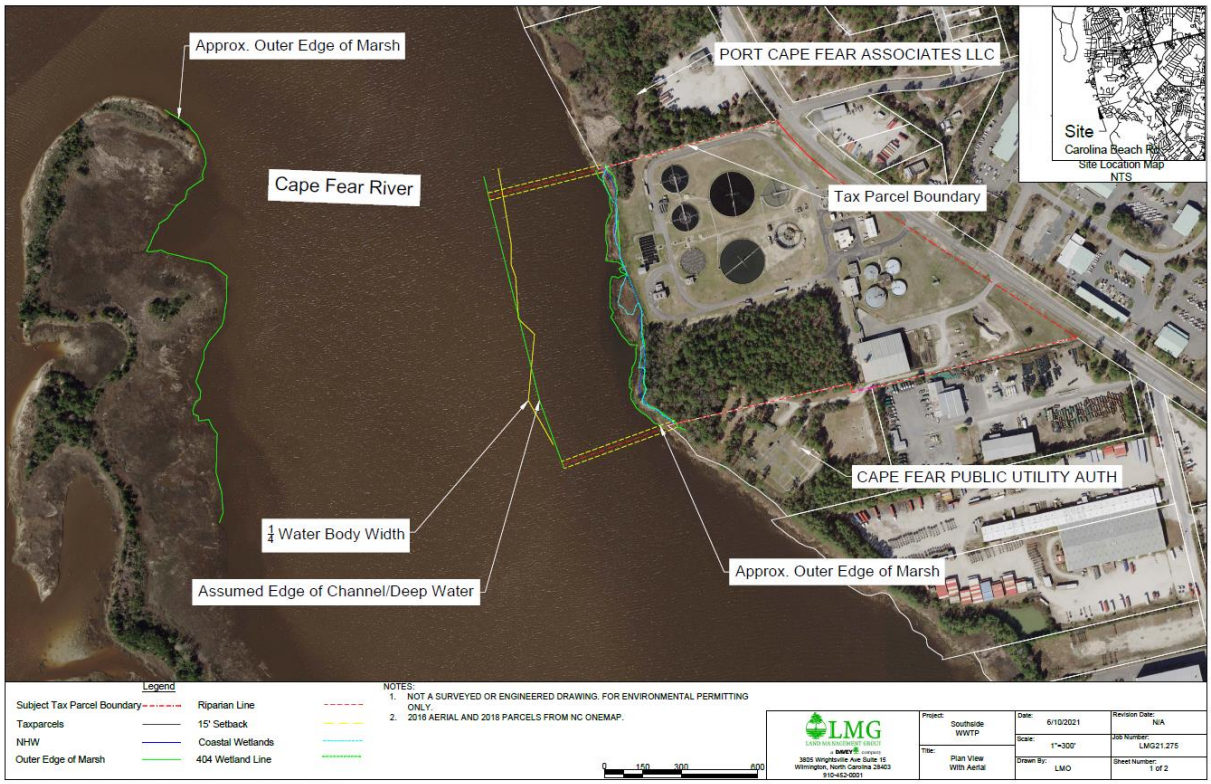
Thanks Bryan!

See attached for LMG maps. The second map shows the NHW and Wetland lines. The work on the WWTP site will be located outside of the NHW and Wetland boundaries. We are still working on the design of the WWTP expansion and are willing to do what is necessary to avoid impacts to land within

the CAMA jurisdiction. What is the required setback from NWH and wetlands to avoid the need for a consistency review?

Let me know.

Thanks!
Katie



From: Hall, Bryan L <Bryan.L.Hall@deq.nc.gov>
Sent: Friday, November 3, 2023 9:36 AM
To: Katie Elliott <KElliott@mckimcreed.com>; MacPherson, Tara <tara.macpherson@deq.nc.gov>
Subject: RE: [External] Consistency Review: SRF ER/EID: New Hanover County

Hi Katie,

It will depend where the work on the property is taking place and what the impacts will be. To see if any proposed work falls within CAMA jurisdiction we'll need to know exactly where high water and coastal wetlands are in relation to the proposed work. High water can either be flagged by DCM to determine Normal High Water or surveyed using elevation to determine Mean High Water. Will work be taking place on the entire parcel? Or is there a more site-specific work plan because knowing the area, some of the parcel falls within CAMA jurisdiction while some of the parcel is outside CAMA jurisdiction.

Let me know if you have any questions.

Thanks,

Bryan Hall
Field Representative
NC Division of Coastal Management
Department of Environmental Quality

(910) 796-7423 office
bryan.l.hall@deq.nc.gov - **Please note my new email address**

127 Cardinal Drive Ext
Wilmington, NC 28405

Find a Field Rep (arcgis.com)



Email correspondence to and from this address is subject to the North Carolina Public Records Law and may be disclosed to third parties.

From: Katie Elliott <KElliott@mckimcreed.com>
Sent: Thursday, November 2, 2023 2:28 PM
To: MacPherson, Tara <tara.macpherson@deq.nc.gov>
Cc: Hall, Bryan L <Bryan.L.Hall@deq.nc.gov>
Subject: RE: [External] Consistency Review: SRF ER/EID: New Hanover County

CAUTION: External email. Do not click links or open attachments unless verified. Report suspicious emails with the Report Message button located on your Outlook menu bar on the Home tab.

Hi Tara,

I hope that you are doing well. I am putting together an ER-EID for a wastewater treatment plant expansion project at the Southside WWTP in southern New Hanover County. The address is 3436 RIVER RD.

Can you please tell me if a consistency review will be required?

I am not sure where the HWL is for the Cape Fear River but I have included the image below which shows the location of the project area.

Thanks!


SOUTHSIDE WASTEWATER
TREATMENT PLANT PROJECT AREA
River Rd. (SR 1100)
Independence Blvd.
Cape Fear River
LEGEND
-2 to 6 ft
6 to 14 ft
14 to 22 ft
22 to 28 ft
28 to 34 ft
34 to 42 ft
42 to 50 ft
50 to 64 ft
0 375 750 1,125 1,500
Feet
Southside WWTP
Replacement & Capacity Upgrade
Topography Map
1 in = 400 ft
M&C No: 03385-0017
Date: Oct 2023
McKIM&CREED
FIGURE: 2

Appendix S

Correspondence Related to Missing USFWS Comments

Patrick Cusack

From: Ajami, Ali <Ali.Ajami@deq.nc.gov>
Sent: Tuesday, July 2, 2024 4:08 PM
To: Patrick Cusack
Cc: Katie Elliott; Tony Boahn; Beeson, Shane
Subject: Re: [External] USFWS Review for Southside WWTP Replacement and Capacity Upgrade

Hi Patrick!

Shane have reached to them five times and unfortunately have not heard back. Please go ahead and submit your revised ER without FWS comments for now. Shane suggest that we cab document the communication without any objection from FWS. Hope this helps.

Please let me know if you have any questions.

Regards,
Ali Ajami *(he/him/his)*
Project Manager, Division of Water Infrastructure
North Carolina Department of Environmental Quality
Office: (919) 707-9183 | Cell: (919) 909-5182
Ali.Ajami@deq.nc.gov

Please note, DEQ email domains have changed so make sure to use my new email address. Any emails sent to my previous email will be forwarded temporarily.

Email correspondence to and from this address is subject to the North Carolina Public Records Law and may be disclosed to third parties.

From: Patrick Cusack <PCusack@mckimcreed.com>
Sent: Monday, July 1, 2024 9:20 AM
To: Ajami, Ali <Ali.Ajami@deq.nc.gov>
Cc: Katie Elliott <KElliott@mckimcreed.com>; Tony Boahn <TBOAHN@mckimcreed.com>
Subject: [External] USFWS Review for Southside WWTP Replacement and Capacity Upgrade

You don't often get email from pcusack@mckimcreed.com. Learn why this is important

CAUTION: External email. Do not click links or open attachments unless verified. Report suspicious emails with the Report Message button located on your Outlook menu bar on the Home tab.

Hi Ali,

I hope that you're enjoying the start of your summer. I am working on the Southside Wastewater Treatment Plant Replacement and Capacity Upgrade project (DWI Project No. CS370923-15). From my understanding we are waiting for some comments from the US Fish and Wildlife Service. Do you have an update on those review comments? We are very close to submitting a revised ER/EID to DEQ and would like to include responses to those comments if they are completed. Thank you!

Best,

Patrick Cusack | Engineering Designer
T 828.252.8181
51 Thompson Street, Suite D, Asheville, NC 28803

PCusack@mckimcreed.com | www.mckimcreed.com

Voted "Best Firm To Work For" - *Zweig Group*





Disclaimer
This e-mail and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this e-mail in error please notify the system manager. Please note that any views or opinions presented in this e-mail are solely those of the author and do not necessarily represent those of the company. Finally, the recipient should check this e-mail and any attachments for the presence of viruses. The company accepts no liability for any damage caused by any virus transmitted by this e-mail.

Email correspondence to and from this address may be subject to the North Carolina Public Records Law and may be disclosed to third parties by an authorized state official.

Appendix T

NC Department of Natural and Cultural Resources Report

NC DEPARTMENT OF
NATURAL AND CULTURAL RESOURCES

Roy Cooper, **Governor**

D. Reid Wilson, **Secretary**

Misty Buchanan
Deputy Director, Natural Heritage Program

NCNHDE-23541

October 5, 2023

Melanee Valdivia
McKim & Creed
243 N Front St
Wilmington, NC 28401
RE: Southside Wastewater Treatment Plant ; 03385-0017

Dear Melanee Valdivia:

The North Carolina Natural Heritage Program (NCNHP) appreciates the opportunity to provide information about natural heritage resources for the project referenced above.

A query of the NCNHP database indicates that there are records for rare species, important natural communities, natural areas, and/or conservation/managed areas within the proposed project boundary. These results are presented in the attached 'Documented Occurrences' tables and map.

The attached 'Potential Occurrences' table summarizes rare species and natural communities that have been documented within a one-mile radius of the property boundary. The proximity of these records suggests that these natural heritage elements may potentially be present in the project area if suitable habitat exists. Tables of natural areas and conservation/managed areas within a one-mile radius of the project area, if any, are also included in this report.

If a Federally-listed species is documented within the project area or indicated within a one-mile radius of the project area, the NCNHP recommends contacting the US Fish and Wildlife Service (USFWS) for guidance. Contact information for USFWS offices in North Carolina is found here: https://www.fws.gov/offices/Directory/ListOffices.cfm?statecode=37.

Please note that natural heritage element data are maintained for the purposes of conservation planning, project review, and scientific research, and are not intended for use as the primary criteria for regulatory decisions. Information provided by the NCNHP database may not be published without prior written notification to the NCNHP, and the NCNHP must be credited as an information source in these publications. Maps of NCNHP data may not be redistributed without permission.

Also please note that the NC Natural Heritage Program may follow this letter with additional correspondence if a Dedicated Nature Preserve, Registered Heritage Area, Land and Water Fund easement, or an occurrence of a Federally-listed species is documented near the project area.

If you have questions regarding the information provided in this letter or need additional assistance, please contact the NCNHP at natural.heritage@dncr.nc.gov.

Sincerely,
NC Natural Heritage Program

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Intersecting the Project Area
Southside Wastewater Treatment Plant
Project No. 03385-0017
October 5, 2023
NCNHDE-23541

Element Occurrences Documented Within Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Rank	Accuracy	Federal Status	State Status	Global Rank	State Rank
Amphibian	35967	Anaxyrus quercicus	Oak Toad	1971-08-12	H	3-Medium	---	Significantly Rare	G5	S2

Natural Areas Documented Within Project Area

Site Name	Representational Rating	Collective Rating
CPF/Lower Cape Fear River Aquatic Habitat	R2 (Very High)	C4 (Moderate)

No Managed Areas Documented within the Project Area

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/help. Data query generated on October 5, 2023; source: NCNHP, Summer (July) 2023. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Within a One-mile Radius of the Project Area
Southside Wastewater Treatment Plant
Project No. 03385-0017
October 5, 2023
NCNHDE-23541

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Rank	Accuracy	Federal Status	State Status	Global Rank	State Rank
Amphibian	35967	Anaxyrus quercicus	Oak Toad	1971-08-12	H	3-Medium	---	Significantly Rare	G5	S2
Amphibian	17115	Rana capito	Carolina Gopher Frog	1975-02-22	H	4-Low	---	Endangered	G2G3	S2
Dragonfly or Damselfly	33738	Somatochlora georgiana	Coppery Emerald	2004-Pre	H?	5-Very Low	---	Significantly Rare	G3G4	S1?
Freshwater Fish	12176	Acipenser brevirostrum	Shortnose Sturgeon	2016-04-07	E	5-Very Low	Endangered	Endangered	G3	S1
Freshwater Fish	38937	Acipenser oxyrinchus oxyrinchus	Atlantic Sturgeon	2018-09	E	4-Low	Endangered	Endangered	G3T3	S2
Mammal	24390	Corynorhinus rafinesquii macrotis	Eastern Big-eared Bat	2006-Pre	E	5-Very Low	---	Special Concern	G3G4T3	S3
Natural Community	31512	Tidal Freshwater Marsh (Cattail Subtype)	---	2012	BC	3-Medium	---	---	G4G5	S3
Natural Community	31513	Tidal Freshwater Marsh (Sawgrass Subtype)	---	2012	BC	3-Medium	---	---	G4?	S4
Reptile	3970	Alligator mississippiensis	American Alligator	2018-02-26	E	4-Low	Threatened Similar Appearance	Threatened	G5	S3
Reptile	34706	Farancia erytrogramma	Rainbow Snake	2019-05-10	BC	3-Medium	---	Significantly Rare	G4	S3
Reptile	12001	Liodytes rigida	Glossy Crayfish Snake	2018-08-20	E	3-Medium	---	Significantly Rare	G5	S2
Reptile	216	Malaclemys terrapin	Diamondback Terrapin	2022-05-07	AB	3-Medium	---	Special Concern	G4	S3
Vascular Plant	30852	Baccharis glomeruliflora	Silverling	1904-Pre	H	5-Very Low	---	Endangered	G4	S1
Vascular Plant	22454	Dichanthelium cryptanthum	Hidden-flowered Witchgrass	1906-05-04	H	5-Very Low	---	Significantly Rare Throughout	G3Q	S2

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Rank	Accuracy	Federal Status	State Status	Global Rank	State Rank
Vascular Plant	28537	Iris prismatica	Slender Blue Iris	2002-05-04	E	3-Medium	---	Significantly Rare Throughout	G4G5	S1S2

Natural Areas Documented Within a One-mile Radius of the Project Area

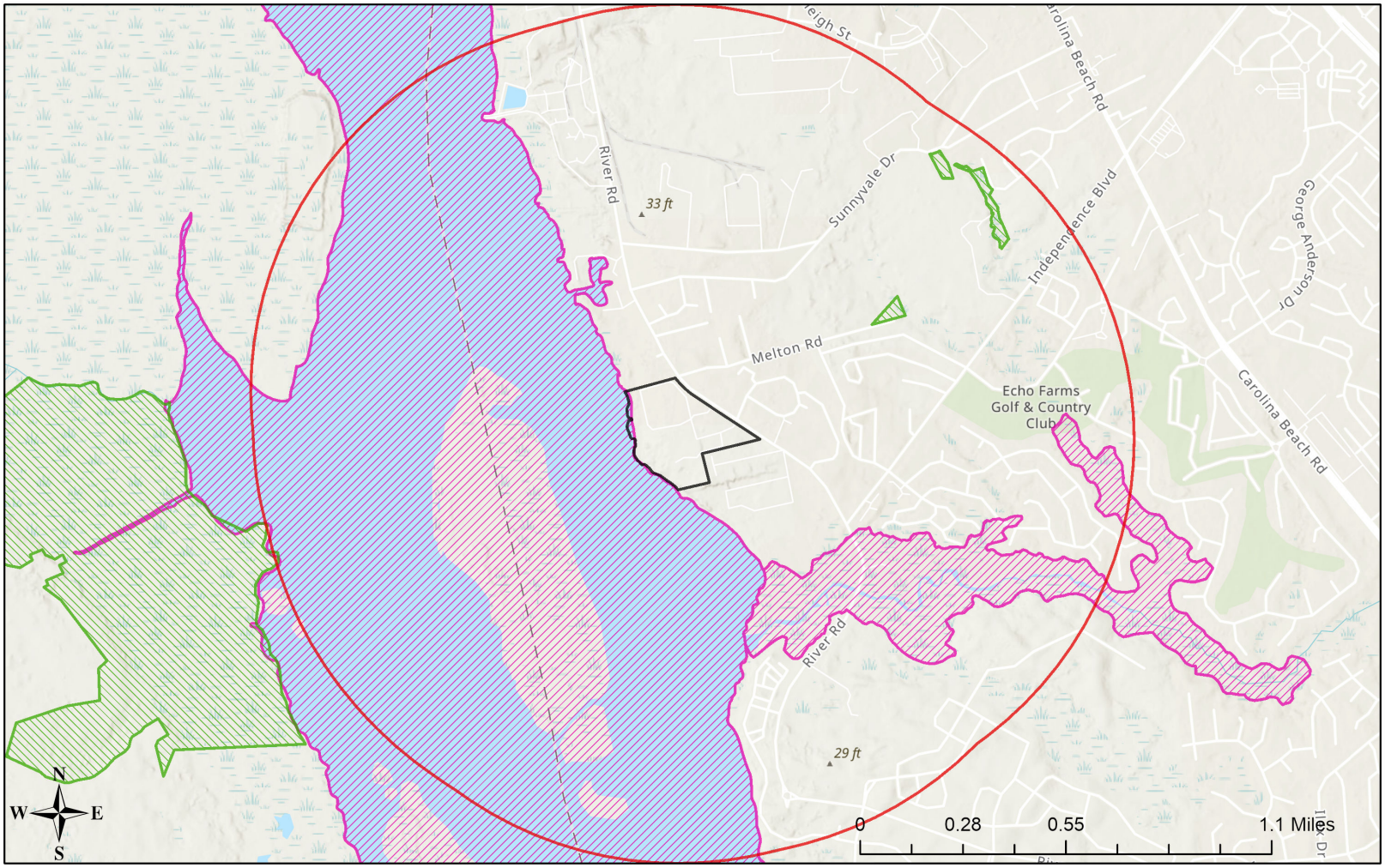
Site Name	Representational Rating	Collective Rating
Barnards Creek Natural Area	R4 (Moderate)	C4 (Moderate)
CPF/Lower Cape Fear River Aquatic Habitat	R2 (Very High)	C4 (Moderate)

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
City of Wilmington Open Space	City of Wilmington	Local Government
City of Wilmington Open Space	City of Wilmington	Local Government
NC Land and Water Fund Conservation Agreement	NC DNCR, NC Land and Water Fund	State

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/help. Data query generated on October 5, 2023; source: NCNHP, Summer (July) 2023. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

NCNHDE-23541: Southside Wastewater Treatment Plant



October 5, 2023

- NHP Natural Area (NHNA)
- Managed Area (MAREA)
- Buffered Project Boundary
- Project Boundary

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community
Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Appendix U

NC Department of Natural and Cultural Resources
Exemption Letter

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary D. Reid Wilson

Office of Archives and History
Deputy Secretary, Darin J. Waters, Ph.D.

November 16, 2023

MEMORANDUM

TO: Melanee Valdivia
Engineering
McKim & Creed
MValdivia@mckimcreed.com

FROM: Ramona M. Bartos, Deputy
State Historic Preservation Officer
RSE for Ramona M. Bartos

SUBJECT: Southside Wastewater Treatment Plant, 3436 River Road, Wilmington, New Hanover County, ER 21-2061

Thank you for your October 3, 2023, submission concerning the above-referenced project. We regret the delay in our response due to an overwhelming workload. We have reviewed the project and offer the following comments.

Our files indicate the wooded portion of the proposed Area of Potential Impact (APE) contains the prehistoric archaeological site 31NH802, which was determined eligible for listing in the National Register of Historic Places. However, the site had data recovery carried out on it and was successfully mitigated under project number ER 08-2099.

We, therefore, have no objection to the expansion of the Southside Wastewater Treatment Plant without further consideration of cultural resources except in the unlikely event that human remains are discovered during construction. Should that occur, it will be the contractor's responsibility to comply with the provisions of North Carolina General Statute Chapter 70, Article 3 "The Unmarked Human Burial and Human Skeletal Remains Protection Act". Construction activities should immediately cease and the county medical examiner contacted.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-814-6579 or environmental.review@dncr.nc.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Appendix V

Memorandum of Agreement
NCDEQ and NCSHPO for SSWWTP

MEMORANDUM OF AGREEMENT

Between
The North Carolina Division of Water Quality
And
North Carolina State Historic Preservation Officer
For
The McKean Maffit (Southside) Wastewater Treatment Plant

WHEREAS, the North Carolina Division of Water Quality (DWQ) is considering the issuance of a permit to the Cape Fear Public Utility Authority (CFPUA) for the McKean Maffit (Southside) Wastewater Treatment Plant (the Undertaking), pursuant to the National Pollutant Discharge Elimination System (NPDES) permitting program (40 CFR § 122); and

WHEREAS, the Undertaking will have an adverse effect upon archaeological site 31NH802, an historic property eligible for listing in the National Register of Historic Places (National Register) that includes multiple prehistoric occupations in New Hanover County, North Carolina; and

WHEREAS, the significance of the historic property is derived from the archaeological remains present and the information they contain; and

WHEREAS, the DWQ has consulted with the North Carolina State Historic Preservation Officer (NCSHPO), pursuant to 36 CFR Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. § 470f) and has determined, in consultation with the NCSHPO that the Undertaking's adverse effect cannot be avoided, and that implementation of the treatment set forth in Stipulations III of this Memorandum of Agreement (MOA) will satisfactorily provide mitigation for the Undertaking's adverse effects on the historic property; and

WHEREAS, CFPUA, the developer of the Undertaking, has participated in the consultation and has been invited to be a signatory to this MOA;

NOW, THEREFORE, the DWQ, the NCSHPO, and CFPUA agree that if the Undertaking proceeds, the Undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the Undertaking on the historic property.

STIPULATIONS

The DWQ shall ensure that the following measures are made a part of any permit issued for the Undertaking, and the CFPUA agrees to accept the following measures as conditions of any issued permit:

I. Definitions

The definitions provided at 36 CFR § 800.16 are applicable throughout this MOA.

II. Area of Potential Effect

The Area of Potential Effect (APE) for the Undertaking is a 6.7-acre tract of land in New Hanover County, North Carolina along the eastern shore of the Cape Fear River. A United States Geological Survey map of New Hanover County showing the APE of the Undertaking is attached hereto as Appendix A.

III. Mitigation of Archaeological Site 31NH802

1. In order to mitigate the adverse effect of the Undertaking on archaeological site 31NH802, which has been determined eligible for the National Register, CFPUA shall employ an archaeological consultant to implement the data recovery plan (attached as Appendix B), which has been approved by the NCSHPO in a letter dating May 5, 2009.

2. Results of the data recovery excavations shall be compiled in a report that meets the Office of State Archaeology reporting guidelines and will be submitted to CFPUA, DWQ, and NCSHPO for review and comment.

3. CPFUA, through its contractor, shall arrange for the conservation treatment and curation of all artifacts, records and materials recovered or generated during the project. Such collections remain the sole property of the land owner(s) of record. Arrangements for donation of archaeological collections with suitable repositories, such as the Office of State Archaeology, are encouraged for purposes of permanent curation and ensured accessibility for future researchers. Any such transfer arrangements by the contractor or CFPUA must be in writing. Any costs associated with the transfer of the artifacts and document collection to the NCSHPO shall be borne by CFPUA. Written commitments for those arrangements shall be included in the final report, or related correspondence, with copies provided directly to CFPUA and the State Archaeologist.

4. Should unmarked human burials or human skeletal remains be encountered during the course of investigation, notification of the proper authorities shall proceed according to the provisions of G.S. 70, Article 3, "The Unmarked Human Burial and Human Skeletal Remains Protection Act".

IV. Dispute Resolution

Should any party to the MOA object within thirty (30) days to any determinations made, actions proposed or the manner of the MOA implementation, the DWQ shall consult with the objecting party to resolve the objection. If the objection cannot be resolved, the DWQ will forward all documentation relevant to the dispute to the Advisory Council on Historic Preservation (Council). Within thirty (30) days after receipt of all pertinent documentation, the Council will either:

1. Provide the DWQ with recommendations which the DWQ will take into account in reaching a final decision regarding the dispute, or

2. Notify the DWQ that it will comment pursuant to 36 CFR Section 800.7(c) and proceed to comment. Any Council comment provided in response to such a request will be taken into account by the DWQ, in accordance with 36 CFR Section 800.7(c)(4) with reference to the subject of the dispute.

Any recommendation or comment provided by the Council will be understood to pertain only to the subject of the dispute; DWQ and CFPUA's responsibility to carry out all of the actions under this agreement that are not the subject of the dispute will remain unchanged.

V. Amendment or Modification

Any party to this MOA, exclusive of concurring parties, may request that it be amended at any time, whereupon the parties to this MOA shall consult to develop an amendment pursuant to 36 CFR §§ 800.6(c)(7) and 800.6(c)(8). The amendment will be effective on the date a copy signed by all of the original signatories is filed with the Council. If the parties cannot agree to appropriate terms to amend the MOA, any party, exclusive of concurring parties, may terminate the MOA in accordance with Stipulation VI., below.

VI. Termination

If the MOA is not amended following the consultation set out in Stipulation V., it may be terminated by any signatory or invited signatory. In the event of termination, the DWQ shall comply with 36 CFR §§ 800.4 through 800.6 with regard to all remaining actions under this MOA.

Effective Date of this MOA

This MOA shall take effect on the date that it is executed by all parties.

Execution of this MOA by the DWQ, NCSHPO, and CFPUA, its subsequent filing with the Council in accordance with 36 CFR § 800.6(b)(1)(iv), and implementation of its terms evidence that the DWQ has afforded the Council an opportunity to comment on the Undertaking and its effect on historic properties, and that DWQ has taken into account the effects of the Undertaking on historic properties.

AGREED:

North Carolina Division of Water Quality

By: _____ Date: 2 Jul 09

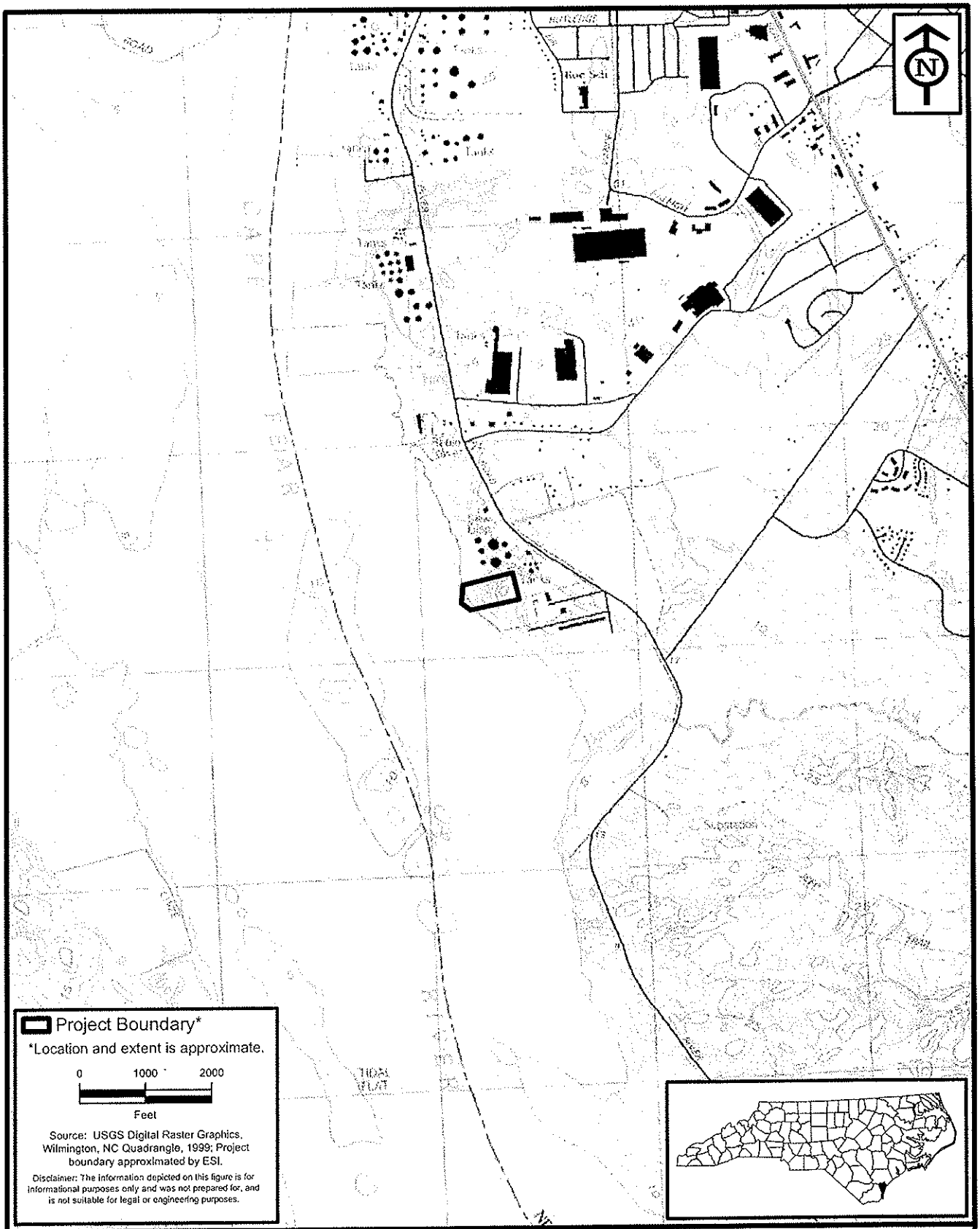
North Carolina State Historic Preservation Officer

Jeffrey J Crow 7/10/09

Cape Fear Public Utility Authority

By: _____ Date: 9/12/09

Appendix A



ENVIRONMENTAL SERVICES, INC.
524 S. New Hope Road
Raleigh, North Carolina 27610
(919) 212-1760
(919) 212-1707 FAX
www.environmentalservicesinc.com

Project Location

Southside WWTP

Wilmington, New Hanover County, North Carolina

Project:	ER08146.00
Date:	Dec 2008
Drwn/Chkd:	EW/SS
Figure:	1.1

P:\GeoGrat\Projects\2008\146\acad\fig1-1_location.dwg, 2/9/2009 10:21:29 AM

Appendix B

DATA RECOVERY PLAN:

DATA RECOVERY OF SITE 31NH802 (SOUTHSIDE SITE) NEW HANOVER COUNTY, NORTH CAROLINA

By:
Terri Russ, RPA
and
Scott Seibel, RPA

For:
McKim & Creed, PA

ER 09-041



April 2009

Environmental Services, Inc.
524 S. New Hope Road
Raleigh, NC 27610

TABLE OF CONTENTS

	Page
INTRODUCTION	1
FORMAT OF A RESEARCH DESIGN	1
PREVIOUS RESEARCH	2
Summary of Survey and Testing Data from 31NH802	2
Summary of Southern Coastal Plain Cultural History	5
SITE CONTEXTS AND RESEARCH	9
Regional Research History	9
Previous Investigations in New Hanover County	11
Project-Specific Research Topics	12
RESEARCH GOALS	14
General Objectives	14
Research Expectations	14
RESEARCH STRATEGIES	16
Contextual Research	16
Field Investigations/Excavation Strategy	16
Analysis	18
REPORT OF INVESTIGATIONS	22
Management Summary	22
Technical Report	22
CURATION OF MATERIALS	23
PROJECT CHANGES	23
ADDITIONAL PROVISIONS	23
PROJECT SCHEDULE	23
PROJECT PERSONNEL	24
SCOPE OF WORK SUMMARY	24
REFERENCES CITED	R1

LIST OF FIGURES

		Following Page
Figure 6.1	Site Location	1
Figure 6.2	Site Plan-31NH802	2
Figure 6.6	Total Ceramic Distribution at Site 31NH802	17

LIST OF TABLES

		Page
Table 1	Ceramics Recovered from the 1979 Excavations at 31NH028.	11
Table 2	Ceramic Variables.	20
Table 3	Wentworth Grain-Size Scale (from Waters 1992).	20

INTRODUCTION

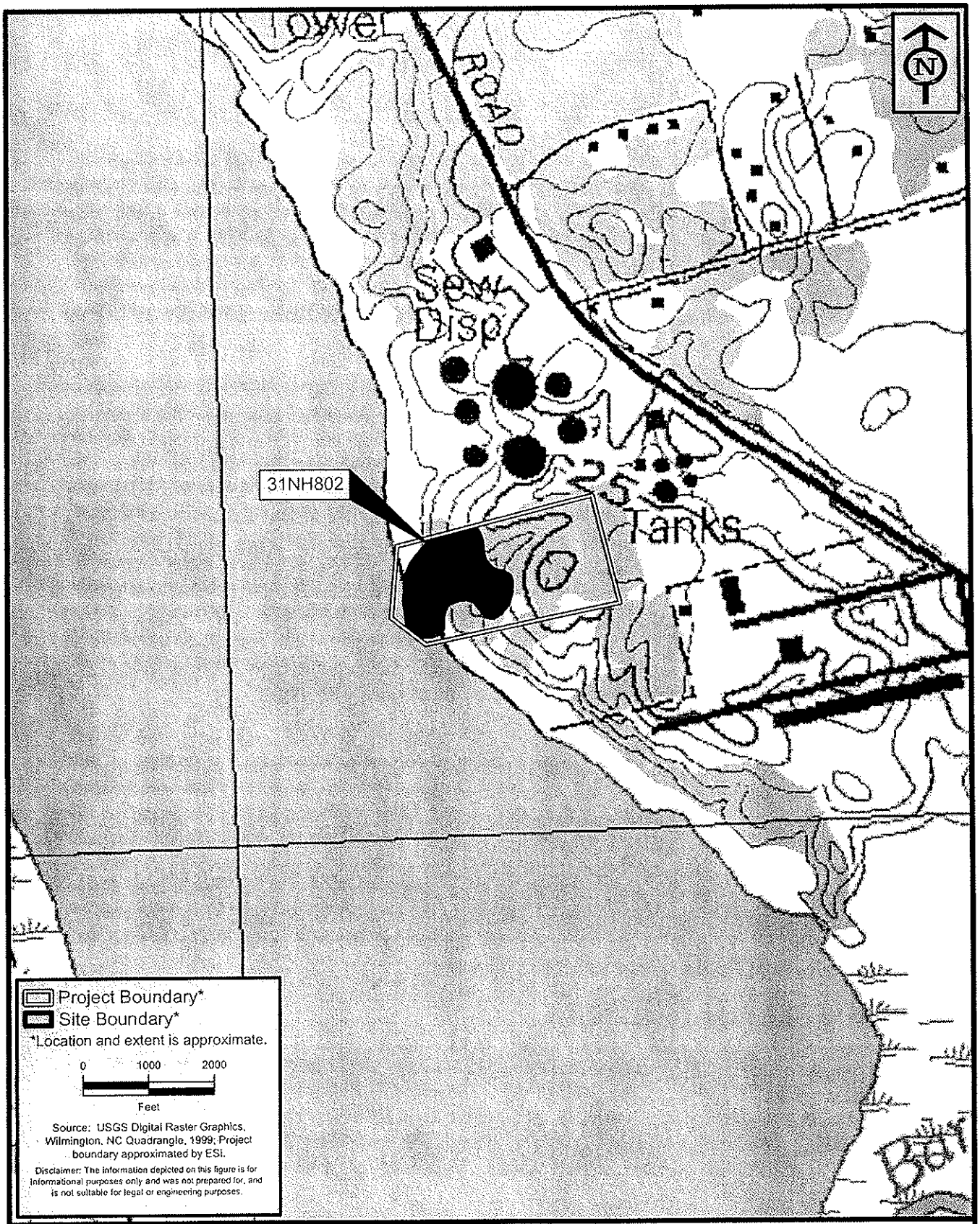
An intensive cultural resources investigation and archaeological site assessment for the proposed expansion and upgrade of the Cape Fear Public Utility Authority's McKean Maffitt (Southside) Wastewater Treatment Plant (WWTP) in New Hanover County, North Carolina was conducted by Environmental Services, Inc., (ESI) of Raleigh, North Carolina, for McKim & Creed, PA, between November 2008 and January 2009 to comply with Section 106 of the *National Historic Preservation Act* (NHPA; 1966, as amended) and requirements of the North Carolina State Historic Preservation Office (SHPO) of the North Carolina Office of Archives and History (Russ 2009).

Based on the results of this investigation, a single archaeological site (31NH802) was recorded (see **Figure 6.1** from Phase I/II report, attached), which is recommended eligible for the *National Register of Historic Places* (National Register) under Criterion D. The site's overall artifact density and the presence of charcoal, faunal remains, and temporally diagnostic ceramics and lithics suggest that the site represents a short term Late Archaic to Middle Woodland habitation. Coastal Plain Early and Middle Woodland sites containing evidence of faunal remains other than aquatic resources are uncommon in the region. Late Archaic Stallings Island and Early Woodland Thoms Creek ceramics are quite rare in North Carolina, especially those recovered from intact subsurface deposits. The recovery of diagnostic ceramics from two features suggests that the site retains additional intact subsurface deposits, including hearths, postholes, or other evidence of Early and Middle Woodland structures and habitation. The site appears relatively undisturbed. Few artifacts were recovered from the uppermost stratigraphic level, and no plow scars or other evidence of subsurface disturbance of the site was observed.

The proposed expansion and upgrade of the Southside WWTP will adversely affect archaeological site 31NH802. This research design is for the archaeological mitigation of site 31NH802 by ESI in anticipation of the adverse effect the proposed project will have on the site. Mitigation activities will focus on the Area of Potential Effect (APE), which is the based on the existing site boundaries of 31NH802 within the parcel boundaries as determined during the initial investigations. This preliminary research design summary is subject to change pending consultation with the North Carolina Office of State Archaeology (OSA), a subdivision of the SHPO, and is intended to provide a general scope for the anticipated work. The overall goal of this data recovery plan is to mitigate adverse impacts to the site such that planning and construction of the WWTP will be allowed to proceed.

FORMAT OF A RESEARCH DESIGN

Prior to field investigations, a formal research design/data recovery plan for the mitigation of site 31NH802 must be approved by the SHPO/OSA. The research design must be consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*, the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation*, and the Advisory Council on Historic Preservation's *Treatment of Archeological Properties: A Handbook.*



ENVIRONMENTAL SERVICES, INC.
524 S. New Hope Road
Raleigh, North Carolina 27610
(919) 212-1760
(919) 212-1707 FAX
www.environmentalservicesinc.com

Site Location

Southside WWTP

Wilmington, New Hanover County, North Carolina

Project:	ER08146.00
Date:	Dec 2008
Drwn/Chkd:	EW/SS
Figure:	6.1

P:\GeoGra\Projects\2008\146\acad\fig6-1_site_loc.dwg 2/9/2009 10:26:42 AM

A research design must specify the following:

(a) The results of previous research relevant to the project;
(b) Research problems or questions to be addressed with an explanation of their relevance and importance;
(c) The field and laboratory analysis methods to be used with a justification of their cost-effectiveness and how they apply to this particular property and these research needs;
(d) The methods to be used in artifact, data, and other records management;
(e) Explicit provisions for disseminating the research findings to professional peers in a timely manner;
(f) Arrangements for presenting what has been found and learned to the public, focusing particularly on the community or communities that may have interests in the results;
(g) The curation of recovered materials and records resulting from the data recovery in accordance with 36 CFR Part 79 (except in the case of unexpected discoveries that may need to be considered for repatriation pursuant to NAGPRA); and
(h) Procedures for evaluating and treating discoveries of unexpected remains or newly identified historic properties during the course of the project, including necessary consultation with other parties.

A formal research design will need to be prepared according to these standards for formal review by the SHPO/OSA. The following presents a summary of the proposed data recovery methodology and associated cost projections.

PREVIOUS RESEARCH

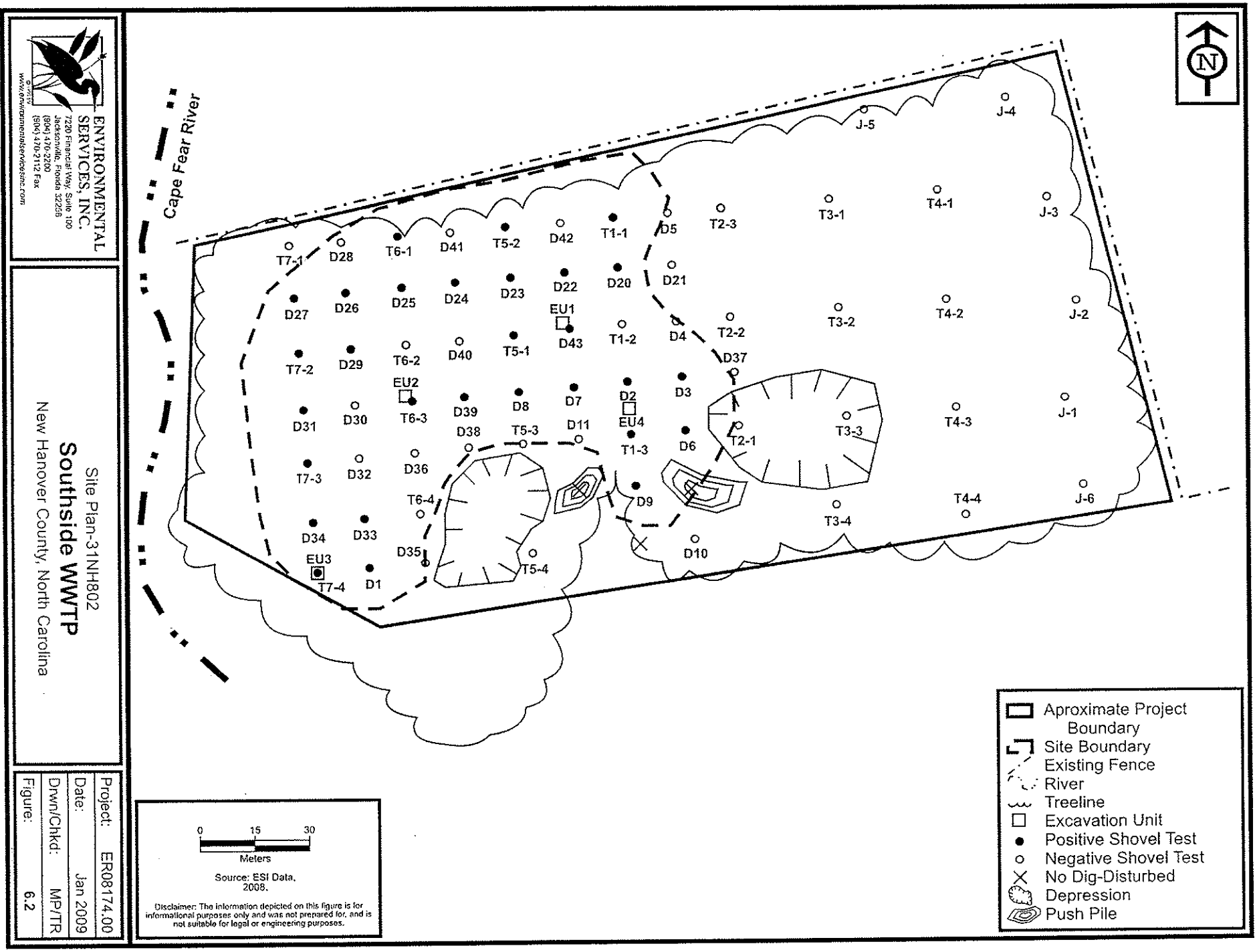
The following section presents a summary of previous investigations at 31NH802, followed by a brief overview of the relevant prehistoric culture history for the Southern Coastal plain region.

Summary of Survey and Testing Data from 31NH802

The approximately 6.7-acre location of the proposed expansion and upgrade of the Southside WWTP was subjected to an intensive cultural resource investigation in 2008 to identify and assess the significance, if possible, of cultural resources that might occur within the study area (Russ 2009). As a result of this investigation, site 31NH802 was recorded. In order to assess the National Register significance of site 31NH802, 53 close-interval shovel tests and four 1-x-1 meter excavation units (EUs) were excavated within the boundaries of the site (see **Figure 6.2** from Phase I/II report, attached).

Project Setting and Field Investigations

The approximately 9,450-square meter site is situated on a forested ridge overlooking the Cape Fear River. Shovel testing yielded prehistoric artifacts including grog, limestone, and sand tempered ceramics, animal bone, and lithic debitage. The majority of the artifacts were



ENVIRONMENTAL SERVICES, INC.
7220 Financial Way, Suite 100
Jacksonville, Florida 32256
(904) 470-2200
(904) 470-2112 Fax
www.environmentalservicesinc.com

Site Plan-31NH802
Southside WWTP
New Hanover County, North Carolina

Project:	ER08174.00
Date:	Jan 2009
Drwn/Chkd:	MP/TR
Figure:	6.2

P:\Projects\2008\ER08-174 Southside WWTP Phil\CorelFig 6.2.cdr; 01/30/09; 3:00 PM

recovered from Strat II between 20 and 80 centimeters below ground surface (cmbgs). An examination of the distribution of artifacts indicated several areas of higher artifact density, as well as a possible horizontal-spatial separation of Early and Middle Woodland ceramics.

Based on the artifact density, depth of recovery, and presence of a possible cultural feature, four EUs, each measuring 1-x-1 meters in size, were excavated in order to determine the archaeological integrity of the site and to assist with determination of National Register eligibility.

Excluding charcoal, whose presence was noted but not counted as individual specimens, the EU excavations yielded 216 additional cultural materials, 178 of which were prehistoric ceramic sherds. In addition, four possible cultural features were noted and investigated, two of which appeared to be cultural features associated with the Middle Woodland period.

Artifacts

A total of 375 artifacts and cultural materials were recovered during the investigation of site 31NH802. Prehistoric ceramic sherds comprised the majority of all artifacts recovered from the site (n=322, 86%). Ceramics exhibited a range of temper, including fine to coarse sand, grog, fiber, and limestone. Surface treatments observed on sherds recovered from this site included cord wrapped paddle, cord wrapped stick, fabric, simple stamped, smoothed, and punctated.

Ceramics affiliated with the Late Archaic period consisted of Stallings Island, a plain, fiber tempered ware. Early Woodland period ceramics included Thoms Creek, a ware which contains temper ranging from fine sand with few inclusions to no visible temper at all; New River, a medium to coarse sand-tempered ware; and Hamp's Landing, a ceramic ware tempered with limestone marl. Middle Woodland ceramics recovered from the investigations at site 31NH802 included Cape Fear, a ceramic ware tempered with sand, and Hanover, a fired clay (grog) or sherd-tempered ware. Of the 267 sherds which could be tentatively affiliated with a specific ceramic series, more than half (n=163, 61%) were likely associated with the Early Woodland period. The remainder were associated with the Middle Woodland period (n=91, 34%) or Late Archaic (n=13, 5%). No ceramics or other cultural materials associated with the Late Woodland period were recovered during the investigation.

An examination of temper types by stratigraphic level for all ceramics suggests that there is intact stratigraphy at site 31NH802 and that the vertical distribution of temper appears to correspond well with the existing cultural typology for the Southern Coastal Plain. Fine sand and fiber tempered ceramics, associated with the Late Archaic and Early Woodland periods, are located in greater amounts in the lower strats, as opposed to Middle Woodland Hanover wares, which appear in greater amounts in Strats I and II. Medium and coarse sand tempered ceramics are somewhat problematic, however, as there is no clear typological definition to date to distinguish among Early and Middle Woodland sand tempered wares. It appears as though the coarse sand wares recovered from 31NH802 may be associated with the Middle Woodland, based on depth of recovery and association with Middle Woodland Hanover ceramics. Medium sand tempered ceramics occur in notable amounts in all three strats, which suggests that the definition of "Medium Sand" as a temper type likely needs to be refined somewhat. A re-

analysis of sand tempered wares based on grain size and abundance may illuminate patterns masked by lumping the ceramics into a single "Medium Sand" category.

Few lithic artifacts (n=17, 5 % of the assemblage) were recovered during the investigations of site 31NH802. Twelve of the lithic artifacts were byproducts of tool fabrication or resharpening and include rhyolite tertiary debitage and a few chert cobble fragments. The remaining lithic artifacts consisted of two very large projectile point fragments recovered from a single shovel test (N1045 E1090) at 50 cmbgs and a small stemmed projectile point base recovered from EU 2. Based on the size and shape of these two knife blades, it is likely that they were associated with the Late Archaic Savannah River typology. Their presence in association with several grog tempered, Middle Woodland period Hanover ceramics suggests that the blades had been cached, curated, or otherwise deliberately deposited. The "mining" of Late Archaic lithic deposits by Woodland period peoples has been documented in Georgia, among other places, and could explain the presence of these two blades. The projectile point fragment may be the base of a Small Savannah River point, generally affiliated with the Late Archaic period; however, small stemmed points are also found in association with Middle Woodland period ceramics. Interestingly, this projectile point was also found in association with Middle Woodland period ceramics.

Other artifacts recovered included charcoal, daub or burned clay fragments (n=6), and faunal remains (n=29). The burned clay fragments did not appear to be associated with a fired ceramic vessel; however, it is unknown whether the material is associated with a structure or merely a byproduct of ceramic vessel construction and firing. The bone fragments could not be associated with a particular species; however, one of the larger bone fragments recovered from ST7-4 (N1000 E1000) exhibited distinct cut or butchering marks. Charcoal was collected from the EUs only; several specimens appear to be burnt nutshell fragments.

Spatial Analysis

An examination of the spatial distribution of ceramics suggests some horizontal separation of artifact concentrations by temporal period. Late Archaic (Stallings Island) ceramics appear to be clustered within the southwestern portion of the site; however, projectile points associated with the Late Archaic period were collected from the eastern portion of the site. Early Woodland ceramics appear to be clustered in several areas across the site; however, the majority of the materials were recovered along an area extending southwest from the edge of the bluff overlooking the Cape Fear River in the northwestern corner of the property to the southwestern edge of the parcel boundary. Given the lack of certainty regarding the existing typology of Middle Woodland sand tempered ceramics, the distribution of grog tempered Hanover wares suggests Middle Woodland activity concentrated in a wide arc covering the entire site; however, additional investigations at the site should refine this distribution somewhat.

Significance and Recommendations

Based on the results of this investigation, Site 31NH802 was recommended eligible for the National Register under Criterion D. The site's overall artifact density and presence of charcoal, faunal remains and temporally diagnostic ceramics and lithics suggested that the site represents a

short term Late Archaic to Middle Woodland habitation. Coastal Plain Early and Middle Woodland sites containing evidence of faunal remains other than aquatic resources are quite rare in the region. Late Archaic Stallings Island and Early Woodland Thoms Creek ceramics are quite rare in North Carolina, especially those recovered from intact subsurface deposits. The recovery of diagnostic ceramics from two features suggests that the site has the potential to retain additional intact subsurface deposits, including hearths, postholes, or other evidence of Early and Middle Woodland structures and habitation. The site appears relatively undisturbed. Few artifacts were recovered from the uppermost stratigraphic level, and no plow scars or other evidence of subsurface disturbance of the site was observed.

Summary of Southern Coastal Plain Cultural History

The following section provides a brief overview of the cultural periods represented at site 31NH802. A more detailed prehistoric chronology can be found in the Phase I and II intensive cultural resources investigation report (Russ 2009).

Late Archaic (3000 - 1000 BC)

By the beginning of the Late Archaic, climatic regimes across the Southeast had become essentially modern, signifying the onset of the Late Holocene. Along the coast, the previously rising Atlantic waters stabilized and relatively modern shoreline configurations were formed. As shorelines stabilized during the transition from the Mid- to Late Holocene, wetlands appear to have increased substantially, allowing for new and expanded subsistence strategies (Watts et al. 1996:37).

Compared to elsewhere in the Southeast, relatively little is known about the Late Archaic in North Carolina and even less in the Coastal Plain. Greater regionalism becomes apparent in Late Archaic adaptations, with increased sedentism and a focus on riverine and coastal resources notable in most areas of the Southeast (Smith 1986; Steponaitis 1986). A generalized hunting-gathering and fishing subsistence strategy was employed, although a few plants such as gourd, squash, sunflower, and chenopodium were cultivated in some areas of the Southeast (Steponaitis 1986:373). While Coastal Plain sites exhibit some of the characteristics noted for the Late Archaic (e.g., stone vessels), other elements such as dense middens and artifacts acquired through long-distance exchange are absent (Steponaitis 1986:372-378). There seems to have been a significant increase in population during the Archaic, and groups began to develop regional habitat-specific adaptations (cultures) and material assemblages (Smith 1986:10). Over time, populations became increasingly sedentary, and a variety of site types evolved, including base camps or villages, short-term bivouacs, procurement camps, and cemeteries.

In general, Late Archaic components are much more prevalent throughout the Southeast than are earlier Archaic and Paleoindian components. Sites dating to the Late Archaic are found in a wide assortment of ecological settings, and significant occupations of floodplains first occurred during this time. Entrenched mobility can be used to describe Late Archaic settlement and subsistence patterning, whereby a series of sites is systematically reoccupied (Graham and Roberts 1986). It can be viewed as a response to decreased mobility in areas with high population densities, and may be an outgrowth of the increasing specialization and decreased

mobility of Middle Archaic groups (Amick and Carr 1996). The Late Archaic experienced a move from highly expedient tool making to an increased degree of curation. Increased investment in the curation of long use-life tools such as bifaces and the logistical procurement of raw materials are seen as responses to decreased availability of lithic raw materials.

Evidence for increased regionalism, which is common throughout the Southeast, occurs in the Coastal Plain with the appearance of the earliest ceramics between 2500 and 2000 BC (Phelps 1983:26-27). These ceramics are a fiber-tempered ware that appears predominantly in the southern portion of the Coastal Plain (i.e., below the Neuse River). This pottery is undecorated and is referred to as Stallings Plain (South 1976:28-29). Thoms Creek pottery, a fine sand or temperless ware generally associated with the Early Woodland period, is considered by some to be contemporaneous with Stallings wares (Trinkley 1980:19).

Savannah River points are the main typological marker of the Late Archaic (Ward and Davis 1999:64), although smaller stemmed and side notched varieties also occurred. Artifacts common during this period included ground stone axes, celts, adzes, pestles, atlatl weights, and beads; lithic projectile points, cruciform drills, scrapers, and knives; and grinding slabs and fire cracked rock (Coe 1964:119). Small containers or bowls carved from soapstone (steatite) were widely distributed throughout much of the interior Southeast during this time (Sassaman 1993). In addition, artifacts made of exotic materials such as copper or whelk/conch shell are found in sites at great distances from their source(s) of origin, implying widespread exchange networks.

General Woodland Period

With trends toward increased population and greater settlement stability established during the Late Archaic, the emergence of small river valley "villages" has been noted throughout the Southeast during the Woodland period (Smith 1986; Steponaitis 1986). Also occurring at this time was a stronger commitment toward horticulture, although hunting, fishing, and gathering remained the primary means of subsistence. Maize may have been first cultivated in areas of the Southeast sometime between AD 200 and 400, but its use in the Coastal Plain was somewhat limited until around AD 1000, although even then "maize agriculture was not particularly important" (Coe 1964:51; Ward 1983:73; Scarry 1993). Earthen and stone mounds containing human burials and other material evidence suggestive of mortuary/ceremonial behavior were constructed over much of the southern Coastal Plain during the Woodland period, but none is known for the project vicinity.

Building on the trends that emerged during the Late Archaic, the Woodland period is characterized by the first widespread use of ceramic pots and the presence of horticulture (Smith 1986; Steponaitis 1986). Accordingly, the beginning of the Woodland period in the Coastal Plain is placed around 1000 BC and continues to about AD 1650 (Phelps 1983:17). By convention the period is divided into three subperiods: Early Woodland, Middle Woodland, and Late Woodland. These divisions, in turn, are associated with various phases that are marked archaeologically by changes in ceramic sequences. Spatial divisions in the Woodland Period in the Coastal Plain can be made as well, roughly comprising the northern and southern halves of the state. The northern region extends from the Neuse River basin to the Virginia state line and roughly encompasses the area occupied by Algonquian and Iroquois speaking groups at the time of European

colonization (Ward and Davis 1999:194). The Iroquois (Tuscaroras) occupied the interior coastal plain, while the Algonquian lived in the eastern tidewater. The southern region extends from the Neuse River basin to the South Carolina state line. During the contact period, this area was inhabited by Siouan speaking peoples (Ward and Davis 1999:194).

Early and Middle Woodland (1000 BC – AD 1000)

Thoms Creek ceramics appear to have a limited range within the North Carolina Coastal Plain; the only reported occurrences of these wares are within the Southern Coastal Plain south of the Neuse River and primarily within Brunswick and New Hanover counties (Mathis 1993:28). These ceramics, generally associated with the first half of the Early Woodland period in North Carolina and the Late Archaic in South Carolina, are likely related stylistically if not temporally to the Late Archaic Stallings fiber tempered wares. Thoms Creek ceramics exhibit a range of fine sand temper with smoothed interiors and a fine, compact paste and texture (Eastman 1991). Decorative attributes include shell punctations, reed punctations, and linear incising.

Two other pottery series are recognized within the Southern Coastal Plain during the Early Woodland period. The New River pottery type is a medium to coarse sand tempered pottery with cord marked, fabric impressed, net impressed, or thong-marked surfaces. While some believe that this type is identical to the Deep Creek ceramic series encountered in the northern coastal region (Phelps 1983), others see them as two separate, but related, traditions (Herbert and Mathis 1996). Interestingly, some archaeologists believe that the New River pottery traditions were influential in Thoms Creek, Deptford, and Mossy Oak traditions in South Carolina and Georgia rather that the other way around (Trinkley 1989:80).

A secondary ceramic type thought to be a transitional type between the Early and Middle Woodland is Hamp's Landing (Hargrove 1993:20). This ceramic contains crushed limestone marl temper and is typically cordmarked, fabric impressed, simple-stamped, and thong-marked (Ward and Davis 1999:202). Some believe that this type is related to the grog tempered Hanover of the Middle Woodland, stating that the size, shape, and density of the temper is more important than the temper type (Jones et al. 1997:101).

Little information is known about settlement patterning and subsistence within the southern Coastal Plain during the Early Woodland period (Phelps 1983:32; Ward and Davis 1999:199). It is suggested that settlement patterns and subsistence strategies during this period resemble those of the preceding Late Archaic, but this has not been proven through archaeological excavation.

Two ceramic traditions mark the Middle Woodland Cape Fear Phase in the southern region: Hanover and Cape Fear. Hanover ceramics are grog (fired clay or crushed sherd) tempered and typically exhibit cord and fabric marking and smoothed surface treatments (Herbert and Mathis 1996:147; South 1976:16). Ceramics of the Cape Fear tradition are sand tempered, and are thought to resemble the Mount Pleasant series of the northern region. Both Cape Fear and Hanover ceramics exhibit similar surface treatment (Herbert and Mathis 1996:149).

It should be mentioned that there is a lack of clarity distinguishing the sand tempered Middle Woodland Cape Fear ceramic series from its sand tempered Early Woodland predecessor, New

River. South (1976) defined Middle Woodland Cape Fear wares as coarse sand tempered ceramics with fabric impressed or cord marked surface treatments. Early Woodland New River ceramics (often subsumed under the Deep Creek series) are similarly described as coarse sand tempered ceramics with simple stamp, net impressed, fabric impressed or cord marked surface treatments. This ambiguity has yet to be clearly resolved.

Settlement during the Cape Fear Phase focused on stream and river banks, estuarine shorelines, and the edges of inland swamps and pocosins (Ward and Davis 1999:205). Although subsistence data is severely lacking except for the consumption of shellfish, it is believed that the Cape Fear Phase followed a pattern of widespread resource utilization, with a focus on estuarine environments (Loftfield 1987).

Excavations at the Broad Reach site (31CR218) in Carteret County have produced possible evidence of Middle Woodland structures (Mathis 1997). Oval and circular post hole features have been found in association with Hanover pottery and suggest the presence of structures approximately 15 feet in diameter, possible semi-permanent shelters. Burials found at Broad Reach and site 31CR223 show that different burial practices existed during the Cape Fear Phase. At Broad Reach, a burial containing two flexed individuals was found, while a mass cremation containing at least 10 individuals was excavated at 31CR223 (Mathis 1993, 1997).

While sand burial mounds found in the Southern Coastal Plain have been considered part of the Cape Fear Phase, some believe them to represent an unnamed Late Woodland phenomenon extending though the Coastal Plains of South Carolina and Georgia (Ward and Davis 1999:210; Trinkley 1989:83). These mounds, that typically measure 25 to 50 feet in diameter and approximately 3 feet in height, contain secondary burials and cremations representing from 10 to over 300 individuals (Phelps 1983; Holmes 1883; MacCord 1966; South 1966; Ward and Davis 1999:206-7). Grave goods recovered from these mounds include chlorite schist and steatite platform pipes similar to Hopewell designs and sand tempered ceramics with fabric-impressing and burnishing, a trait not found in Cape Fear ceramics (MacCord 1966).

Late Woodland-Contact Periods (AD 1000-1700)

The White Oak Phase represents the Late Woodland in the Southern Coastal Plain. Although it exhibits differences from the Colington Phase of the Northern Coast that will be discussed below, many more similarities exist. Both Phases had similar house designs, village size, and internal organization, as well as a mixed subsistence economy relying strongly on shellfish and other marine resources. Shell-tempered pottery was a major trait of both Phases, and evidence exists that Algonquian languages were spoken as far south as Onslow County. Not only do both exhibit very similar burial styles, skeletal remains from White Oak Phase interments are very similar to Algonquian skeletons from the Colington Phase. Data suggest that Algonquian culture spread as far south as the Onslow and Pender county lines, though it is more likely that the inhabitants of site 31NH802 were affiliated with the Siouan culture (Ward and Davis 1999:222; Loftfield 1990; Ward 1982).

White Oak pottery (also referred to as Oak Island) is shell-tempered, a major similarity to Colington, though typical surface treatments are somewhat different. White Oak ceramics are

often fabric-impressed, smoothed, plain, cordmarked, simple-stamped, and net impressed, just like Colington ceramics. However, White Oak ceramics are never incised as Colington ceramics are, but are sometimes burnished, which is rarely found on Colington pottery (Loftfield 1976:157-163; South 1976; Ward and Davis 1999:217).

There are still numerous issues surrounding the identification of White Oak pottery (Herbert 1997:17-18; Herbert and Mathis 1996:151). Misidentification is a significant issue, with White Oak possibly being confused with Hamp's Landing, which dates to the Early and Middle Woodland and is limestone/marl tempered. Also, some of the surface treatments, including simple stamping, cord marking, and net impressing, are believed to be much more common in the Early and/or Middle Woodland periods.

A major trait of the White Oak phase is secondary burial in large ossuaries. Ossuaries excavated in Onslow County have contained up to and possibly in excess of 150 individuals (Loftfield 1990:119; Ward 1982:5). Excavations at Broad Reach have revealed smaller group burials containing less than 10 individuals each, some containing distinct, articulated bundles and others containing mixed, disarticulated remains (Mathis 1993:4-5). Variance in burial patterning between and even within ossuaries is thought to reflect differences in social standing of the interred individuals, both in relation to grave goods and the condition of the bones (Mathis 1993:5-7).

Around the Cape Fear River, however, it appears that a somewhat different cultural tradition was present. Excavation at the Cold Morning site (31NH28, discussed in more detail in the following section) in New Hanover County revealed a small ossuary containing the disarticulated remains of 15 individuals in association with White Oak pottery. The burial style is in contrast with the large ossuaries found in Onslow County. Additionally, analysis of the skeletal remains found strong similarity with Siouan peoples from the Piedmont (Coe et al. 1982:88). Incising of over one quarter of the sherds recovered is also a surface treatment not found anywhere else in the southern region; it is, however, found in the northern region (Ward and Davis 1999:223).

SITE CONTEXTS AND RESEARCH

This section presents a discussion of previous research conducted in the Coastal Plain of North Carolina applicable to site 31NH802. A brief history of Coastal Plain archaeology is provided, followed by a discussion of recent studies that will be used both as foundations for the research questions to be addressed by the excavation of site 31NH802, as well as comparative sources for interpretation of this site.

Regional Research History

Archaeological research in the Coastal Plain of North Carolina has had a fairly brief history, beginning in earnest with descriptive efforts and chronology building in the 1950s and continuing with broader research topics concerning settlement patterns and cultural interactions.

No archaeological investigation of the prehistory of the Coastal Plain can be undertaken without a discussion of the work of William Haag. The first extensive archaeological survey of the

North Carolina Coastal Plain was directed by Haag between 1954-1955 and represents one of the formative collections of archaeological data specifically related to Coastal North Carolina archaeology (Haag 1958). Initiated as a comprehensive survey of the Cape Hatteras area and a search for the "Lost Colony", this collection of site descriptions and artifact analyses includes sites from the Hatteras, Bodie, Ocracoke, and Colington Islands; the Albemarle and Pamlico Sound areas; the Neuse River; and Roanoke Island. Haag supplemented Coe's 1952 North Carolina Piedmont cultural sequence with detailed descriptions of stone tools, pottery attributes, and a comparative discussion of the distribution of various temper and surface treatments of over 14,000 ceramic sherds and created the first generalized chronology for Coastal ceramics (Haag 1958).

The next large-scale study of Coastal prehistory was undertaken by Stanley South in 1960 (South 1976). This investigation of 71 sites was undertaken with the intention of supplementing both Haag's work in the Northern Coastal Plain and the established ceramic sequence of the South Carolina Savannah River area. Although Joffre Coe's 1964 *Formative Cultures of the Carolina Piedmont* and 1952 *Cultural Sequence of the Carolina Piedmont* established the general Paleoindian and Archaic chronology for much of the entire Southeast region, including the Coastal Plain, a Southern Coastal Plain ceramic chronology was largely absent prior to South's work.

Thomas Loftfield continued the focus on developing and refining the cultural chronology for the Coastal Plain in the 1970s with his identification of Central Coastal Plain ceramic series (Loftfield 1976). Around the same time, David Phelps began his work refining the ceramic chronology initiated by Haag (Phelps 1983).

In addition to developing the ceramic chronology for the Coastal Plain region, Phelps conducted some of the earliest cultural resource management studies in the area. Phelps' 1981 *Archaeological Surveys of Four Watersheds in the North Carolina Coastal Plain* is a collection of early environmental impact studies conducted by East Carolina University between 1974 and 1975. These studies not only addressed basic questions of chronology and typology, but also addressed broader topics of site distribution and compared archaeological sites in both Tidewater and Inner Coastal Plain environments.

Phelps' research indicated that the Inner Coastal Plain supported a greater density of sites than Tidewater region; however, regardless of physiography, there are more Archaic sites in the Coastal Plain than any other component. Early Woodland sites are also prominent and appear to be a continuation of Archaic traditions. These conclusions, based on the survey data, build on Phelps' cultural sequence (Phelps 1980) and support his Cultural-Spatial Model, which argues that there are no regional archaeological distinctions between the Inner and Outer Coastal Plain prior to the Woodland period (Phelps 1980; Phelps 1981). Phelps' continued work in the region over the next few decades suggested several research areas, including the investigation of shifts in technology and subsistence strategies during the transition from the Archaic to Woodland and Early to Middle Woodland periods (Phelps 1983).

Previous Investigations in New Hanover County

To date, including the Southside Site, 802 archaeological sites have been recorded in New Hanover County. The following section presents a discussion of some of the representative recent archaeological investigations conducted within New Hanover County and the immediate vicinity.

31NH028

The Cold Morning site (31NH028) was first excavated in 1977 as part of the New Hanover County Archaeological Survey project sponsored by the Comprehensive Employee Training Act (C.E.T.A.). Test excavations exposed an ossuary burial pit, and a site mitigation plan was developed. In the fall of 1979, the Research Laboratories of Archaeology (RLA) at the University of North Carolina at Chapel Hill (UNC-CH) conducted excavations with the goal of documenting and removing the ossuary and associated cultural materials (Coe et al. 1982; Ward and Wilson 1980).

The ossuary contained at least 16 individuals, including adults, subadults, and one fetus. The remains are likely associated with Siouan groups. In addition to the human skeletal material, the initial ossuary excavation recovered 823 ceramic sherds, the majority of which were associated with the Middle Woodland period. Later investigations focused on determining the spatial structure of the site, the integrity of subsurface features, and the larger temporal association of the ossuary and its presumed Woodland components.

A total of 35 shovel tests, twelve 2-x-2 meter excavation units, and one 1-x-4 meter trench were excavated at the Cold Morning site. An additional 1,142 ceramic sherds were recovered, the majority of which were associated with the Cape Fear pottery series (**Table 1**).

Table 1: Ceramics Recovered from the 1979 Excavations at 31NH028.

Ceramic Type	N=	%
Cape Fear	629	55.1%
Hanover	237	20.8%
Oak Island	137	12.0%
UID Sand	81	7.1%
UID Quartz	50	4.4%
UID Steatite	8	0.7%
Total	1142	

In addition to the previously established pottery types, a fine sand tempered ware was also recovered (see **Table 1;** "*UID Sand*"). Although no temporal association of these fine sand tempered sherds was made, the surface treatments (plain, fabric, cord, and thong marked) suggest that these sherds may represent an Early Woodland Stallings Island component. Also, the shell tempered, Late Woodland Oak Island sherds recovered from the Cold Morning site were described as "hole-tempered" on the basis of the angular voids left behind by the leaching of the temper material. It is possible that some of these ceramics may be better classified as

limestone or marl-tempered Hamp's Landing wares (an Early Woodland type) based on this description.

In summary, the Cold Morning site, though utilized over a long period of time, contained no evidence of structures, middens, or other signs of habitation. The bulk of the ceramics suggest that the site was largely used during the Middle Woodland period. The ossuary was solely associated with the Late Woodland period and reflects an isolated use of the site.

31NH142

Excavations at site 31NH142, the Hamp's Landing Site, resulted in the identification of a previously undefined prehistoric ceramic ware type, now known as Hamp's Landing (Hargrove 1993). The pottery is characterized by the limestone temper and a range of surface treatments (plain, thong-marked, fabric impressed, simple stamped). Although the stratigraphic relationships among the ceramics from this site were not well defined, the Hamp's Landing ceramics were found in association with Thom's Creek sherds and were recovered below Middle Woodland Hanover and Cape Fear ceramics (Hargrove and Eastman 1997; Herbert and Mathis 1996). Hamp's Landing ceramics are believed to date to the Early Woodland period.

31NH707

Two large-scale surveys were conducted prior to the construction of the Wilmington Bypass. A 1994 survey identified eight previously unrecorded sites and revisited five previously recorded sites (Klein et al. 1994). Of the 13 sites, 11 contained prehistoric components and two contained historic components. The 11 prehistoric sites contribute to an archaeological district that was recommended eligible for listing in the National Register. Six archaeological sites (31NH707-712) were recorded during the 1997 survey of portions of the Wilmington Bypass corridor (Barse 1997). Only site 31NH707, a Woodland period occupation site, was recommended as eligible for listing in the National Register.

31NH801

An intensive cultural resources investigation of a proposed expansion of the GLE property recorded site 31NH801, a Middle Woodland short-term habitation site located on a bluff overlooking a remnant of an extinct paleochannel of the Northeast Cape Fear River. The site contained intact subsurface features as well as faunal remains. The site was recommended eligible for the National Register (Russ and Postlewaite 2008).

Project-Specific Research Topics

The majority of archaeological work in the Coastal Plain today is carried out as a result of cultural resource management. While primarily undertaken with the purpose of compliance, data collection, and site mitigation, Cultural Resource Management archaeology and the resulting body of "gray literature" can offer a wide range of research topics. The following discussion focuses on recent investigations applicable to the current research topics to be addressed by the excavation of site 31NH802, which may be broadly defined as:

- Cultural Chronology and Ceramic Typologies
- Site Function and Settlement Patterns
- Feature analysis, resource exploitation, and subsistence patterning

Late Archaic – Early Woodland Period Research

The presence of Thom's Creek and Stallings Island Wares (associated with the Late Archaic period in South Carolina and the Early Woodland period in North Carolina) at 31NH802 suggest the presence of a transitional Late Archaic – Early Woodland component. Archaic sites in the Coastal Plain region are largely limited to surface collections. The lack of stratified Archaic remains in the Coastal Plain region of North Carolina limits the conclusions that can be drawn concerning settlement patterns and subsistence. Without excavated data, researchers are limited to information gathered from stratified Archaic sites from the Piedmont region. Data collected from excavations of succeeding Woodland period sites are also used to hypothesize Archaic period site function and subsistence.

General studies of Archaic site distribution suggest that Coastal Archaic locations appear to be less specialized and located irrevocably related to stream accessibility and of a less specialized nature (Mouer 1991:10). Mouer speculated that the generalized nature of Coastal Archaic settlements may be due to the "patchy, zoned, and highly seasonal resource distributions" of the Coastal Plain. Evidence of seasonality of the resources exploited by the prehistoric inhabitants of 31NH802 could contribute to the growing database of information regarding Archaic subsistence patterns.

Klein and Klatka's 1991 analysis of Late Archaic and Early Woodland demography and settlement patterns investigated trends in the occupation and resource exploitation of Inner and Outer Coastal Plain sites (1991:158). Settlements tended to shift from the Inner Coastal Plain to estuarine environments from the Archaic to Early Woodland period. Unfortunately, the argument for increased exploitation of estuarine resources is limited by the lack of data regarding Early and Middle Archaic sites potentially submerged or buried beneath deposited sediments (Steponaitis 1987: 90-95). Site 31NH802 has the potential to yield information pertaining to the Late Archaic – Early Woodland transition in settlement location and structure.

Research conducted by Binford (1964), Turner (1976), and Barfield (1990) indicated an abundance of available plant resources during the Late Archaic and Early Woodland period. Though the archaeological evidence for this reliance on plants as a focal resource is limited, the presence of specific plant resources, especially those with multi-seasonal availability, implies a higher degree of sedentism. The identification of edible floral resources in feature deposits from site 31NH802 could be argued to represent a focal adaptation, as archaeological evidence suggests that these plant species are contributors to the subsistence base of Late Archaic and Early Woodland populations.

Woodland Period Research

An archaeological investigation of the Cape Island site (31ON190), a Woodland site in Onslow County conducted by TRC Garrow in 1996, addressed several research issues that may be applicable to the current investigation of 31NH802 (Jones et al. 1997). One of the primary research issues for this project concerned structural patterns on the North Carolina coast. Specifically, the authors questioned whether longhouses were characteristic of other Woodland Coastal Plain inhabitants or were exclusively associated with Algonquian groups. Seasonality and site function were additional topics addressed by evidence of changes in the frequency of wild versus domesticated plants and the presence of permanent occupations. While it is not certain that prehistoric structures will be encountered at 31NH802, structural patterns and ethnobotanical remains recovered from 31ON190 could serve as a useful comparative database for research concerning resource exploitation and site function.

Also, investigations at the Cape Island site suggested additional investigations of the chronological affiliation of Hamp's Landing ceramics. Hargrove (1993) reportedly recovered Hamp's Landing ceramics stratigraphically above Thom's Creek and below Hanover sherds. As a result, Hargove suggested a late Early Woodland to Middle Woodland time period for the Hamp's Landing series. The recovery of Hamp's Landing ceramics in clear association with dateable materials from a feature context should provide this series with a radiometric confirmation (or challenge) of the existing temporal range.

Randy Daniel's work at the Barber Creek site (31PT259) in Pitt County focuses on stratified Early-Middle Holocene remains in the Coastal Plain (Daniel 2002). The site, located on a relic dune, offers specific research topics that may be applied to the current investigations at 31NH802. First, the presence of pottery associated with dateable charcoal and nutshell fragments offers a comparative collection of Early and Middle Woodland ceramics with associated radiocarbon dates. In addition, the lithic assemblage includes the presence of non-local stone, suggesting some degree of cultural interaction, stone curation, or trade, which can be compared with the lithic assemblage from 31NH802.

RESEARCH GOALS

General Objectives

The general objective of the archaeological mitigation of site 31NH802 is to collect archaeological data from the site sufficient to mitigate adverse impacts to the site. Tasks necessary to complete this project include contextual research, archaeological excavation, artifact identification and spatial and statistical analyses, and report preparation and submittal.

Research Expectations

The presence of intact deposits and materials associated with Southern Coastal Plain Late Archaic-Early Woodland and Middle Woodland procurement activities presents the opportunity to greatly enhance the archaeological database of these understudied site types. The activities

described in this research design are designed to answer these questions in a cost-efficient manner.

A number of broad research areas for North Carolina were identified in the *North Carolina Comprehensive Historic Preservation Plan* (Division of Archives and History [DAH] 1995). In addition, some areas of pertinent research may be gleaned from one of the more informative compilations of broad research designs for eastern North Carolina, even though it was prepared eighteen years ago (United States Army Corps of Engineers [USACE] 1986). Incorporating current settlement pattern models that have been developed by researchers working in the Coastal Plain of North Carolina, South Carolina, and southern Virginia are applicable to the proposed investigation of site 31NH802. Additional information may also increase our current understanding of the distribution of prehistoric occupations over the landscape through time and the types of sites that characterized these occupations. Artifacts could be discussed in terms of how they assist in identifying and explaining these settlement systems.

> *The history of archaeological research in the North Carolina Coastal Plain is analogous to three generations of scholars, each reflecting the research goals, level of methodological sophistication and theories of its time. But unlike normal generational sequences that accrue information passed either genetically or socially, each generation of archaeological researchers seems to have taken its own direction, ignoring clues and problems posed by the preceding work.*
> (Phelps 1983:6)

For the most part, the slow development of archaeology in the region has been due in large measure to the absence of research continuity and the narrowly defined research designs and goals of many projects. "The cumulative result of previous work leaves us in the unenviable position of attempting cultural synthesis and explanation while still accumulating data on the classificatory-descriptive level necessary for sound cultural-historical models" (Phelps 1983:6).

As summarized in the intensive cultural resource investigation (Russ 2009), mitigation activities at 31NH802 are expected to produce a wide range of important research information and answers to research questions. These questions can be organized into three main avenues of inquiry: Chronology, Site Organization, and Subsistence; however, many of the specific research questions to be addressed by the data recovery of 31NH802 may encompass more than one of these subjects.

Chronology

It is expected that the data recovery of 31NH802 will be able to address three cultural-chronological issues regarding the southern Coastal Plain region. First, the existing typology for Woodland period ceramics will be explored through the use of radiometric dating and stratigraphic seriation techniques. More specifically, it is hoped that the Early Woodland-Middle Woodland sand tempered ceramic typology can be better defined both temporally and stylistically though investigations at 31NH802. Finally, it is expected that radiometric dating will clarify the temporal placement of Stallings Island and Thoms Creek ceramics within the southern North Carolina Coastal Plain region.

Activity Areas and Spatial Organization of Site

On a site specific level, the data recovery investigations will attempt to recover evidence of semi-permanent structures or site furniture. Investigations will also try to clarify the spatial organization of the different temporal components of the site. On a more regional level, the data recovery should illuminate how the site fit into known models of prehistoric land use patterns.

Subsistence & Sedentism

Non-marine subsistence remains at Early and Middle Woodland coastal Plain sites are rare. It is expected that the presence of floral and faunal remains will be able to address questions regarding the seasonality of the site. Information gathered from the analysis of food remains will be compared to what is currently understood about Early and Middle Woodland subsistence and sedentism in the region. In addition, microanalysis of flotation samples and detailed analysis of any faunal remains recovered during excavation could contribute to the analysis of feature function and overall site function. The analysis of ethnobotanical samples should also address the presence or absence of domesticated species.

RESEARCH STRATEGIES

Contextual Research

Additional research will be conducted at the OSA and other appropriate sources in an attempt to locate more detailed information about the Late Archaic - Woodland periods in the region in order to better understand and interpret the individual archaeological components that may be encountered during this investigation.

Field Investigations/Excavation Strategy

Excavations at site 31NH802 will conform to the Secretary of Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (36 CFR 61) and will follow these standards:

1. A permanent datum will be placed in the site vicinity and all excavation units will be located in reference to the datum.
2. Measurements will be recorded using metric system units.
3. Prior to excavations, a plan view of the surface features and elevations of the site will be mapped.
4. A system of designation of individual cultural features, excavation units, and levels will be devised and keyed to the excavation drawings, written records, and photographs.
5. Excavation units will be a standard size (1-x-1 meters for excavation units), although these units may be excavated discretely as contiguous units within larger excavation blocks (2-x-2 meter to 4-x-5 meter blocks), as appropriate. Cultural features will be excavated discretely, rather than within units.

6. All hand-excavated soils will be sifted through 0.25-inch mesh, except that a finer mesh may be substituted for sifting of feature soils or other special samples. Excavated levels will conform to natural soil strata as much as possible. Soils will be described using standardized measures such as Munsell Soil Color Charts.
7. All cultural features will be properly recorded. Feature locations will be tied into the general site map. Written descriptions of features will include dimensions, shape, matrix color and texture, depth below surface, stratigraphy, and recovered materials. Features will be mapped in plan view prior to cross-section excavation and in profile to record the cross-section. Features will be excavated by methods appropriate to their size and type, for example, post holes will be bisected, half of the fill removed, and one profile recorded; trash pits may be fully excavated if the material appears to date to the period of occupation/significance.
8. Flotation and/or fine-screened samples of feature fill will be processed for floral and faunal analysis if appropriate materials are present.
9. A photographic record of the excavations will be maintained, including black and white or color photographs of all features in plan view and cross-section and at least one soil profile of each excavation unit.

Specifically, excavations will focus on the areas of the site indicated during the initial survey and testing phases as containing intact subsurface deposits and areas of higher artifact densities (see **Figure 6.6** from Phase I/II report, attached). Formal excavations will consist of individual 1-x-1 meter excavation units [EUs] within contiguous block excavations ranging in size from 2-x-2 meters ($4m^2$) to 4-x-5 meters ($20m^2$) in size r larger. The main goals of the excavation units will be the uncovering of cultural features and the recovery of cultural artifacts and remains. It is expected that a minimum of 140 and a maximum of 165 square meters of excavation units will be formally excavated as part of the proposed data recovery.

Sediments from the shovel tests and excavation units will be excavated in 10-centimeter arbitrary levels within natural soil stratigraphic levels (strats).

Feature Excavation

Feature types expected include post holes (archaeological remnants of domestic structures, palisaded walls, etc.) and pit features (food storage pits, cooking pits, refuse pits, etc.). Post holes will be differentiated from pits and possible pit features. A ten percent sample of the identified post holes will be fully excavated (up to a maximum of 50), while the rest will be tested using a "cut and confirm" method, whereby a profile of the post hole will be cut with a flat bladed shovel to confirm if the feature is indeed a post hole or is non-cultural.

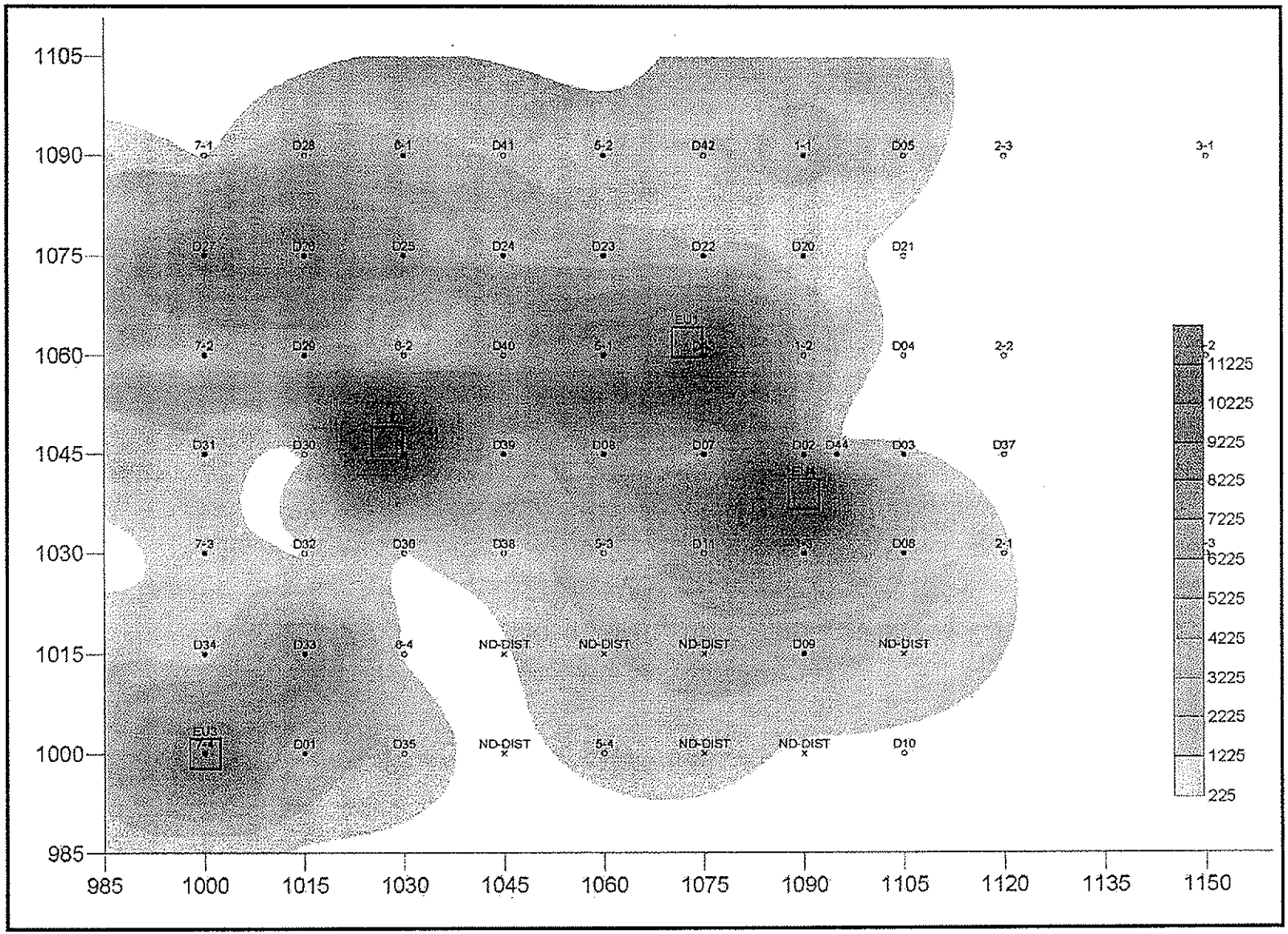
Based on the results of the Phase I and II investigations at 31NH802, it is estimated that no more than 100 pit features will be encountered. A maximum of 100 pit features will be fully excavated by hand. Written descriptions of features will include dimensions, shape, matrix color and texture, depth below surface, stratigraphy, and recovered materials. Pit features will be mapped in plan view prior to cross-section excavation, and in profile to record the cross-section.

ENVIRONMENTAL SERVICES, INC.
524 S. New Hope Road
Raleigh, North Carolina 27610
(919) 212-1760
(919) 212-1707 Fax
www.environmentalservicesinc.com

Total Ceramic Distribution at Site 31NH802

Southside WWTP

New Hanover County, North Carolina



Total ceramic distribution (values represent total ceramic surface area).

Project:	ER08174.00
Date:	Jan 2009
Drwn/Chkd:	MP/SS
Figure:	6.6

P:\Projects\2008\ER08-174 Southside WWTP Phase II\Cores\Fig 6.6.cdr 02/02/09, 9:30 AM

If more than 100 pit features are encountered, a representative sample of the total (i.e. 50%) will be partially hand excavated (bisected) up to a maximum of 100 additional features. If over 200 pit features are encountered, additional consultation with the Client and the SHPO will be necessary to determine if reductions can be made in the sampling strategy or if additional excavations may be necessary. Any additional work required by the SHPO would be addressed on a Time and Materials basis under a separate scope of work and contract.

A photographic record of the excavations will be maintained, including photographs of all features in plan view and cross-section. Soils will be described for color and texture using standardized measures such as Munsell Soil Color Charts. All measurements will be recorded using metric system units. All excavated sediments will be screened through 0.25-inch hardwire mesh. Sediment collected from any excavated features, except for postholes, will include either 25 percent of the feature sediment or 1 gallon, whichever is less. These soil samples will be processed through 0.125-inch or smaller hardwire mesh in order to collect smaller ethnobotanical materials such as seeds.

Recovered artifacts will be placed in bags and marked with unit location, depth of recovery, artifact types, excavator's initials, and a field specimen (FS) number. Pertinent field data, including unit locations, soil stratigraphy, environmental setting, topography, etc. will be recorded on formal excavation unit and feature forms.

All excavation units and features will be plotted using a Sokkia Total Station tied to a permanent datum. The location of the datum and a minimum of four additional points will be located in real world coordinates using a sub-meter accuracy Trimble GPS unit. This will allow the site mapping to be properly projected in a Geographic Information Systems (GIS) environment. This data will be for informational purposes only and will not be survey-grade, as ESI is not a licensed survey firm.

Analysis

A high volume of artifacts may be anticipated for 31NH802. The excavation of 1-x-1 meter excavation units during the Phase II investigation yielded as many as 140 artifacts per square meter. It is estimated that a maximum of 23,000 artifacts will be recovered and subjected to analysis. If more that 23,000 artifacts are recovered, the analysis will primarily focus on diagnostic materials (i.e. identifiable ceramics and diagnostic lithic tools).

Upon completion of the fieldwork, the artifacts and data will be processed and analyzed according to standard and site specific archaeological procedures. Analysis will include the preparation of maps showing the location of units and artifact classes/densities and classification and quantification of artifacts and other cultural materials. Artifacts collected as a result of the field investigations will be used to determine the time periods during which the site was utilized and the types of activities that occurred.

Analysis will focus on three main aspects:

1. Artifact Analysis: Artifacts will be analyzed, typed, quantified, and described in comparison to both established and proposed typologies.
2. Feature Content Analysis: If features, like refuse pits, are encountered, the fill material will be subjected to fine screening (wet or dry) and samples of the matrix will be taken for flotation processing to recover floral and faunal samples for analysis. Artifacts from features will also be used to aid in functional assessment and temporal assignment of features.
3. Intra-site Pattern Analysis: A site plan or plans will be drawn, showing the topographic contours of the site, landmarks, the site excavation grid, features and important site data plotted during the excavation. Excavation blocks, units, or trenches may be shown separately for clarity, but should be keyed to an overall site map. Photographs, stratigraphic drawings, artifact density maps and other illustrations will be used as necessary to support interpretations.

Ceramic Artifact Analysis

All prehistoric sherds recovered will be brushed clean of surface dirt, washed, and allowed to air dry. Whenever refitted sherds will be noted in the assemblage, they will be mended and counted as one item during analysis. Each sherd will be examined to identify surface treatment, temper, and manufacturing technique.

When possible, sherds will be classified according to published pottery types for the region, although precautions will be taken not to force sherds into existing ceramic classifications. Diagnostic ceramics will be used to identify aboriginal cultural affiliation(s) and to determine relative dates for site activities. Rim profiles (straight, incurvate, excurvate, etc.) and lip forms (round, flat, beveled, etc.) will be described, and attributes such as sherd thickness will be measured.

Those sherds not easily attributed to an existing diagnostic type will be assigned a descriptive name based on temper (fine, medium, or coarse sand, fiber, shell, etc.) and/or exterior surface treatment. Temper is defined as any nonplastic added to clay to reduce shrinkage and/or breakage during working, drying, and/or firing processes (Rice 1987:483). Aplastic material added during initial preparation of raw clay increases workability and requires that less water be added to achieve optimal plasticity, thereby decreasing drying time. Recent studies have shown that within a ceramic tradition, subtle changes in temper size may be used to identify ceramic change through time. **Table 2** presents the main variables that will used in the ceramic analysis, though additional variable categories may be added, if necessary.

The analysis of temper is based on the methodology used by Clay Swindell in the analysis of ceramics from site 31HF99 in Hertford County, North Carolina (Holm *et al.* 1999) and the Riversound site (31CO167/167**) in Chowan County (Seibel 2009). These analyses used a slightly modified Wentworth grain-size scale to classify the size of inclusions in the paste. The Wentworth scale (**Table 3**) is used by geologists and geomorphologists, among others, for grain-size classification as it is objective and systematic. Each classification was used as a single analytical category. The amount of each temper size category relative to the overall sherd will

also be estimated. Three classifications were used: Rare (<10 percent); Common (10-40 percent); and Abundant (>40 percent).

Table 2: Ceramic Variables.

Primary Temper	Secondary Temper	Exterior Surface	
Very fine sand	Very fine sand	Plain	Net-impressed
Fine sand	Fine sand	Eroded	Burnished
Medium sand	Medium sand	Unidentified	Incised
Coarse sand	Coarse sand	Cord-marked	Punctated
Very coarse sand	Very coarse sand	Cross-cord-marked	Smoothed
Granule	Granule	Cord-wrapped-stick	Scraped
Pebble	Pebble	Fabric-impressed	
None	None		

Table 3: Wentworth Grain-Size Scale (from Waters 1992).

Classification	Size Range
Very fine sand	0.074-0.125 mm
Fine sand	0.125-0.25 mm
Medium sand	0.25-0.50 mm
Coarse sand	0.50-1.00 mm
Very Coarse sand	1.00-2.00 mm
Granule	2.00-4.00 mm
Pebble	4.00-64.00 mm

Lithic Analysis

During the analysis, all lithic artifacts will be counted, identified as to material type, and examined under magnification (10-60x) as needed. To determine their relative position on the reduction continuum, flakes will be categorized on the basis of observable surface cortex. Primary flakes (PF) exhibit cortex over 100% of their outer surface, while secondary flakes (SF) possess cortex over less than 100% of their outer surface. Flakes that lack cortex on the outer surface will be classified as tertiary flakes (TF). Shatter are defined as angular fragments of stone that have been clearly modified, but lack a clear bulb of percussion.

A detailed morphological analysis will be undertaken of each core, biface, and tool, during which the mode of modification (bifacial, unifacial) as well as the production stage will be determined and recorded. Metric information such as maximum length (ML), maximum width (MW), and maximum thickness (MT) will also be recorded and given in that order (ML x MW x MT). All metric information will be measured with a SkillTech caliper (maximum instrumental error = 0.5 mm). Bifacial tools and points will be analyzed according to a modified five part staging scheme based on morphological characteristics that identifies different stages within a single or multiple lithic reduction strategy (Goode n.d. [in Johnson 1995 and Black et al. 1997]).

Specialized Analysis

A maximum of five (5) samples will be submitted for C-14 and/or thermo-luminescence (TL) dating. Ethnobotanical remains, faunal remains, and shell will be analyzed in-house.

Geomorphology

Geomorphologist Keith Seramur of Appalachian State University will conduct a geomorphological study of the site. Mr. Seramur is a well-respected geomorphologist in North Carolina and across the Southeast who has nearly 10 years of experience working on geomorphological processes at archaeological sites.

In the Coastal Plain of North Carolina sandy deposits along rivers can be fluvial and aeolian deposits. Sedimentology of the deposits can be used to distinguish between aeolian and fluvial deposits. Stratigraphy is often difficult to see in sandy Costal Plain sediment and leaching of organics in these acidic soils can remove visual evidence of buried A-horizons. Changes in grain size distribution with depth are used to identify the contact between stratigraphic horizons and to follow these contacts across the landform. The stratigraphy in select test units will be investigated.

Bioturbation has influenced the vertical distribution of artifacts at most archaeological sites. However, much of the cultural context in stratified archaeology sites can be preserved even in the loose, sandy Coastal Plain sediment. The effects of bioturbation are assessed with the results of the grain size analyses by comparing the depth of burial of different cultural components with the depth of stratigraphic boundaries. Artifacts that are not in the proper stratigraphic position have probably been moved through the profile as a result of bioturbation.

The geomorphological investigation will include:

- Detailed sediment sampling and particle size analyses to delineate stratigraphy in the test units. Closely spaced sediment samples (5 cm-10 cm intervals) will be collected from the upper 1.0 meter of select excavation units. These sediment samples will be analyzed for particle size distribution. Statistical measures will be calculated and plotted to observe subtle changes in sedimentology down the profile.
- The strata will be correlated with cultural stratigraphy and radiocarbon dates (as available) to assess the timing of the depositional events that buried cultural horizons, the formation of the landform and the Holocene depositional history.
- Keith Seramur will prepare a report of the geomorphology describing field observations, laboratory results, geomorphic context of Site 31NH802 and the Holocene depositional history of the landform. The report will discuss changes in the landform since occupation, including possible erosion along the riverbank.

Sediment samples will be collected from excavation unit profiles to distinguish and interpret the different stratigraphic units recorded across the terrace. If it is not possible to reach the base of cultural deposits because of groundwater, the physical limitations of the alluvium or OSHA standards, then sediment cores and/or auger cuttings will be collected to evaluate deeper deposits. Organic samples and bulk samples of buried A-horizons can be collected for radiometric dating. Excavation unit profiles and cores are to be described and interpreted to determine the depositional processes and sedimentary environment at each core location. These descriptions will include pedogenic horizons, visual sedimentology, and laboratory particle-size analyses. Data collected from the trenches and cores will be used to identify the base of deposits likely to contain artifacts, evaluate the potential for buried archaeology sites and interpret the Holocene stratigraphy. The Holocene stratigraphy, radiocarbon dates and soil development will be used to interpret landform development and age of the deposits.

Spatial Analysis

Analysis of the spatial patterning of features and artifact distributions will be used to determine the organization and use of space. Using plan maps and artifact data generated during the field investigations, an analysis of horizontal and vertical cultural patterning will be undertaken in a GIS environment. This will involve the digitizing of all feature plan drawings, linking them to the Total Station locational data for each feature and a data table containing pertinent feature information (i.e. type, size, cultural affiliation, etc.). Horizontal and vertical distributions of diagnostic artifacts will be studied to determine if spatial-temporal variations in the former use of the site exist. Additionally, feature types and artifact distributions will be studied in an attempt to identify structures or other use patterns. These patterns will be displayed in a graphical format.

REPORT OF INVESTIGATIONS

Management Summary

A brief summary report of the investigation results will be prepared at the conclusion of fieldwork. It will describe preliminary interpretations and the course of analysis, certify that the research design was implemented, and that the fieldwork specified has been completed. This summary shall include a description of the field investigations, a general summary of findings to date, and any recommendations.

Technical Report

Following completion of the analysis, a report will be prepared detailing the results of the mitigation of site 31NH802. The report will meet the requirements of the OSA's *Guidelines for Preparation of Archaeological Survey Reports* and the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716) and *Format Standards for Final Reports of Data Recovery Programs* (42 FR 5377-79). ESI will deliver one hard copy of the Draft Report to the SHPO for review. Following receipt of SHPO comments to the Draft Report, ESI will prepare the Final Report. Three hard copies and one digital copy of the Final Report will be delivered to the SHPO, along with a revised site form for 31NH802.

CURATION OF MATERIALS

All artifacts recovered during this project are the property and responsibility of the landowner. However, the curation of recovered materials and records resulting from the data recovery is required in accordance with 36 CFR Part 79. Artifacts will be stored temporarily at ESI's laboratory facility, at no cost to the Client, until space is available for permanent curation in a facility maintained by the North Carolina Department of Cultural Resources (DCR). The DCR does charge a fee for the curation of project materials.

PROJECT CHANGES

Unforeseen constraints or unexpected findings may necessitate changes to the Scope of Services. If changes to the scope are recommended by ESI, all involved parties will consult about the need for such changes.

ADDITIONAL PROVISIONS

1. Should unmarked human burials or human skeletal remains be encountered during any of these investigations, ESI will notify the proper authorities as provided under the provision of North Carolina General Statute 70(3) "The Unmarked Human Burial and Human Skeletal Remains Protection Act."
2. ESI will provide all materials, supplies, vehicles, and personnel, other than those expressly provided by the Client and approved by the Client project manager.

PROJECT SCHEDULE

Milestones set are as follows*:

- Initiate Fieldwork
  - Within ten (10) business days of Notice to Proceed from client and approval of the Memorandum of Agreement (MOA) by the client, the Division of Water Quality (DWQ) and the SHPO
- Complete Fieldwork
  - Within 12 weeks of initiation of fieldwork, access/weather permitting
- Submission of Management Summary
  - Within 2 weeks of completion of fieldwork
- SHPO Clearance for Construction
  - Within 30 days of submission of Management Summary
- Submittal of Draft Report
  - Within six months of completion of analysis

*All dates and time projections are dependant upon timeliness of SHPO response, client review and approval of the materials to be submitted to the SHPO, and/or access to the site.

PROJECT PERSONNEL

All supervisory project personnel will meet the qualifications for professional archaeologists as listed in the Secretary of the Interior's *Professional Qualification Standards* (48 FR 22716). Scott Seibel will serve as Principal Investigator and Terri Russ will serve as Field Director. Additional staff and crew will assist in both field and laboratory work, as needed.

SCOPE OF WORK SUMMARY

The data recovery of site 31NH802 is based on the following assumptions:

- **A minimum of 140 square meters and a maximum of 165 square meters of excavation units**
- **Recovery and analysis of up to 23,000 artifacts**
- **A maximum of five (5) samples will be submitted for C-14 and/or thermo-luminescence (TL) dating**

REFERENCES CITED

Advisory Council on Historic Preservation
1980 *Treatment of Archaeological Properties: A Handbook.* General Printing Office, Washington, D.C.

Barfield, E. B.
1990 *Current Prehistoric Data on Cultivation and Domestication Proximal to and in the Uplands of Virginia.* Paper presented at the Fourth Upland Symposium, Harrisonburg, Virginia.

Barse, W.P.
1997 *Addendum, Phase I Survey, Wilmington Bypass, Center Alternative New Hanover County, North Carolina.* Ms. on file, Office of State Archaeology, Raleigh.

Binford, L. R.
1964 *Archaeological and Ethnohistorical Investigation of Cultural Diversity and Progressive Development Among Aboriginal Cultures of Coastal Virginia and North Carolina.* Ph.D. Dissertation, University of Michigan, Ann Arbor.

Coe, J. L.
1964 The Formative Cultures of the Carolina Piedmont. *Transactions of the American Philosophical Society*, 54. Philadelphia, Pennsylvania.

1952 The Cultural Sequence of the North Carolina Piedmont. In *Archaeology of the Eastern United States.* J. Griffin (ed.). University of Chicago Press, Chicago, Illinois. pp.301-311

Coe, J.L., H.T. Ward, M. Graham, L. Navey, H. Hogue, and J.H. Wilson, Jr.
1982 *Archaeological and Paleo-osteological Investigations at the Cold Morning Site, New Hanover County, North Carolina.* Research Laboratories of Anthropology, University of North Carolina, Chapel Hill.

Daniel, I. R., Jr.
2002 Stratified Early-Middle Holocene Remains in the North Carolina Coastal Plain. Southeastern Archaeological Conference Special Publication No. 7.

Division of Archives and History (DAH)
1995 *Legacy: A Preservation Guide into the Twenty-First Century for North Carolinians: North Carolina's Comprehensive Historic Preservation Plan for the 1990s.* North Carolina Division of Archives and Historic, Raleigh.

Eastman, J.M.
1991 *Prehistoric Ceramics of North Carolina: A Quick Tour of the Published Literature.* Coastal Carolina Research, Inc. Tarboro.

Goode, G. T.
n.d. Cited in Black, S. L., L. W. Ellis, D. G. Creel, and G. T. Goode, 1997, *Hot Rocks Cooking on the Greater Edwards Plateau: Four Burned Rock Midden Sites in West Central Texas,* Volume 2. Studies in Archaeology 22. Texas Archaeological Research Laboratory. pp. 456-457.

Graham, R. W., and A. Roberts
1986 Residentially Constrained Mobility: A Preliminary Investigation of Variability in Settlement Organization. *Haliksa'i: UNM Contributions to Anthropology* 5:105-16.

Haag, W. C.
1958 *The Archaeology of Coastal North Carolina.* Louisiana State University Press, Baton Rouge.

Hargrove, T.H.
1993 *Archaeological Excavations at 31NH142, Hamp's Landing, River road Park, New Hanover County, North Carolina.* Ms. on file, Office of State Archaeology, Raleigh.

Hargrove, T.H., and J.M. Eastman
1997 Limestone- or Marl-Tempered Ceramics from the Lower Cape Fear River Region, New Hanover County, North Carolina. *North Carolina Archaeology* 46:91-108.

Herbert, J. M., and M. Mathis
1996 An Appraisal and Re-Evaluation of the Prehistoric Pottery Sequence of Southern Coastal North Carolina. In *Indian Pottery of the Carolinas: Observations from the March 1995 Ceramic Workshop at Hobcaw Barony.* D. G. Anderson, J.S. Cable, N. Taylor, and C. Judge (eds.). Council of South Carolina Professional Archaeologists, Columbia.

Holm, M. A., C. Swindell, and L. Lautzenheiser
1999 *Data Recovery at Site 31HF99, Hertford County, North Carolina.* Ms. on file, North Carolina Department of Transportation, Raleigh.

Holmes, J. A.
1883 Indian Mounds of the Cape Fear. Reprint *Southern Indian Studies* 18:48-54.

Jones, D. C., C. T. Espenshade, and L. Kennedy
1997 *Archaeological Investigations at 31ON190, Cape Island, Onslow County, North Carolina.* Garrow and Associates, Atlanta.

Klein, M. J., and T. Klatka
1991 Late Archaic and Early Woodland Material Culture in Virginia. In *Late Archaic and Early Woodland Research in Virginia: A Synthesis.* T.R. Reinhart and M. Hodges (eds.). Virginia Department of Historic Resources, Richmond. pp. 139-183.

Klein, Terry H., Joseph M. Herbert, and Suzanne S. Pickens
1994 *Phase I Archaeological Survey, Wilmington Bypass, New Hanover and Brunswick Counties, North Carolina.* Ms. on file, Office of State Archaeology, Raleigh.

Loftfield, T.
1990 Ossuary Interments and Algonkian Expansion on the North Carolina Coast. *Southeastern Archaeology* 9(2):116-123.

1987 *Excavations at 31ON305, the Flynt Site at Sneads Ferry, North Carolina.* Ms. on file, Office of State Archaeology, Raleigh.

1976 *"A Brief and True Report..."An Archaeological Interpretation of the Southern North Carolina Coast.* Ph. D. Dissertation, University of North Carolina, Chapel Hill.

MacCord, H., Sr.
1966 The McLean Mound, Cumberland County, North Carolina. *Southern Indian Studies* 18:3-45.

Mathis, M. A.
1997 *Middle to Late Woodland Shift on the Southern Coast of North Carolina.* Ms. on file, Office of State Archaeology, Raleigh.

1993 Mortuary Processes at the Broad Reach Site. Paper presented at the 50th Annual Meeting of the Southeastern Archaeological Conference, Raleigh.

Mouer, L. D.
1991 The Formative Transition in Virginia. In *Late Archaic and Early Woodland Research in Virginia: A Synthesis.* T. R. Reinhart and M. Hodges, (eds.). Special Publication No. 23. Virginia Department of Historic Resources, Richmond. pp. 1-88.

National Historic Preservation Act (NHPA)
1966 *National Historic Preservation Act.* Code of Federal Regulations, Title 36, Part 800. United States of America, Washington, D.C.

Office of State Archaeology (OSA)
1995 *Archaeological Curation Standards and Guidelines.* Division of Archives and History, North Carolina Department of Cultural Resources, Raleigh, North Carolina.

Phelps, D. S.
1983 Archaeology of the North Carolina Coast and Coastal Plain: Problems and Hypotheses. In *The Prehistory of North Carolina: An Archaeological Symposium*. M. A. Mathis and J. J. Crow (eds.). North Carolina Department of Cultural Resources, Division of Archives and History, Raleigh, North Carolina. pp. 1-51

1981 *Archaeological Surveys of Four Watersheds in the North Carolina Coastal Plain.* North Carolina Archaeological Council Publication No. 16. North Carolina Archaeological Council and North Carolina Department of Cultural Resources, Raleigh.

1980 *Archaeological Salvage of the Thorpe Site and Other Investigations Along the U.S. 64 Bypass, Rocky Mount, North Carolina.* Archaeological Research Report No.1, East Carolina University, Greenville, North Carolina.

Rice, P. M.
1987 *Pottery Analysis: A Sourcebook.* The University of Chicago Press, Chicago.

Russ, T.A.
2009 *An Intensive Cultural Resource Investigation: McKean Maffitt (Southside) Wastewater Treatment Plant, Cape Fear Public Utility Authority, New Hanover County, North Carolina.* Environmental Services, Inc., Report of Investigations No. 1295, Raleigh, North Carolina.

Russ, T.A., and M. Postlewaite
2008 *An Intensive Cultural Resource Investigation: Potential GE Expansion, New Hanover County, North Carolina.* Environmental Services, Inc., Report of Investigations No. 1126, Raleigh, North Carolina.

Sassaman, K. E.
1993 *Early Pottery in the Southeast: Tradition and Innovation in Cooking Technology.* University of Alabama Press, Tuscaloosa.

Scarry, C. M. (ed.).
1993 *Foraging and Farming in the Eastern Woodlands.* University Press of Florida, Gainesville.

Secretary of the Interior
1992 *Standards for the Treatment of Historic Properties*

1983 *Standards and Guidelines for Archeology and Historic Preservation.* 36 CFR 61.

N.D. *Format Standards for Final Reports of Data Recovery Programs.* 42 FR 5377-79.

Seibel, S.
2009 *Data Recovery of the Riversound Site (31CO167/167**), Chowan County, North Carolina.* Environmental Services, Inc., Report of Investigations No. 1285, Raleigh, North Carolina.

Smith, B. D.
1986 The Archaeology of the Southeastern United States: From Dalton to deSoto (10,500 B.P. - 500 B.P.). In *Advances in World Archaeology*, Volume 5. F. Wendorf and A. E. Close (eds). Academic Press, New York. pp. 1-92.

South, S.
1976 *An Archaeological Survey of Southeastern North Carolina.* University of South Carolina Institute of Archaeology and Anthropology Notebook 8. Columbia.

Steponaitis, V.P.
1986 Prehistoric Archaeology in the Southeastern United States 1970-1985. *Annual Review of Anthropology* 15: 363-404.

Steponaitis, L. C.
1987 *Prehistoric Settlement Patterns in the Lower Patuxent Drainage, Maryland.* Ph. D. Dissertation, Department of Anthropology, State University of New York, Binghamton.

Trinkley, M.B.
1989 An Archaeological Overview of the South Carolina Woodland Period: It's the Same Old Riddle. In *Studies in South Carolina Archaeology: Essays in Honor of Robert L. Stephenson*, edited by Albert C. Goodyear, III and Glen T. Hanson, pp. 73-87. Occasional Papers of the South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Anthropological Studies No. 9. Columbia.

1980 Investigation of the Woodland Period Along the South Carolina Coast. Unpublished Ph.D. Dissertation, Department of Anthropology, University of North Carolina, Chapel Hill.

Turner, E. R.
1976 *An Archaeological and Ethnohistorical Study of the Evolution of Rank Societies in the Virginia Coastal Plain.* Ph. D. Dissertation, Department of Anthropology, Pennsylvania State University.

Ward, H.T.
1982 *Archaeological Salvage of the Jarretts Point Ossuary, On304.* Research Laboratories of Archaeology, University of North Carolina, Chapel Hill.

Ward, H. T., and R. P. S. Davis, Jr.
1999 *Time Before History: Archaeology of North Carolina.* The University of North Carolina Press, Chapel Hill, North Carolina.

Ward, T.H., and J.H. Wilson
1980 Archaeological Excavations at the Cold Morning Site. *Southern Indian Studies* 32:5-40.

Waters, M.R.
1992 *Principles of Geoarchaeology: A North American Perspective*. University of Arizona Press, Tuscon.

Watts, W. A., E. C. Grim, and T. C. Hussey
1996 Mid-Forest of Florida and the Coastal Plain of Georgia and South Carolina. In *Archaeology of the Mid-Holocene Southeast*. K. E. Sassaman and D. G. Anderson (eds). University Press of Florida, Gainesville. pp. 28-40.



ENVIRONMENTAL SERVICES, INC.

www.environmentalservicesinc.com

Providing Superior Solutions to Environmental, Natural, and Cultural Resource Needs

Appendix W

NCDEQ Practice Standards and Specifications

Dust Control

6.84

DC

DUST CONTROL

Definition

The control of dust resulting from land-disturbing activities.

Purpose

To prevent surface and air movement of dust from disturbed soil surfaces that may cause off-site damage, health hazards, and traffic safety problems.

Conditions Where Practice Applies

On construction routes and other disturbed areas subject to surface dust movement, and dust blowing where off-site damage may occur if dust is not controlled.

Planning Considerations

Construction activities that disturb soil can be a significant source of air pollution. Large quantities of dust can be generated, especially in "heavy" construction activities such as land grading for road construction and commercial, industrial, or subdivision development.

In planning for dust control, it is important to schedule construction operations so that the least area is disturbed at one time.

Leave undisturbed buffer areas between graded areas wherever possible.

The greatest dust problems occur when the probability of rainfall erosion is least. Therefore, do not expose large areas of soil, especially during drought conditions.

Install temporary or permanent surface stabilization measures immediately after completing land grading.

Design Criteria

No formal design procedure is given for dust control. See Construction Specifications below for the most common dust control methods.

Construction Specifications

Vegetative cover—For disturbed areas not subject to traffic, vegetation provides the most practical method of dust control (*References: Surface Stabilization*).

Mulch (including gravel mulch)—When properly applied, mulch offers a fast, effective means of controlling dust.

Spray-on adhesive—Examples of spray-on adhesives for use on mineral soils are presented in Table 6.84a.

Table 6.84a
Spray-on Adhesive for Dust Control on Mineral Soil

	Water Dilution	Type of Nozzle	Apply Gallons/Acre
Anionic asphalt emulsion	7:1	Coarse Spray	1,200
Latex emulsion	12.5:1	Fine Spray	235
Resin in water	4:1	Fine Spray	300

Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist, but not so high as to cause water pollution or plant damage.

Sprinkling—The site may be sprinkled until the surface is wet. Sprinkling is especially effective for dust control on haul roads and other traffic routes.

Stone used to stabilize construction roads can also be effective for dust control.

Barriers—A board fence, wind fence, sediment fence, or similar barrier can control air currents and blowing soil. Place barriers perpendicular to prevailing air currents at intervals about 15 times the barrier height. Where dust is a known problem, preserve windbreak vegetation.

Tillage—Deep plow large open undisturbed areas and bring clods to the surface. This is a temporary emergency measure that can be used as soon as soil blowing starts. Begin plowing on the windward edge of the site.

Maintenance

Maintain dust control measures through dry weather periods until all disturbed areas have been stabilized.

References

Surface Stabilization
6.10, Temporary Seeding
6.11, Permanent Seeding
6.14, Mulching

Other Related Practices
6.80, Construction Road Stabilization

Appendix X

City of Wilmington General Ordinances
Chapter 6. Article II. Noise Control

ARTICLE II. NOISE CONTROL[1]

Sec. 6-26. Purpose.

The provisions hereinafter contained are enacted pursuant to the authority granted to the city under G.S. § 160A-184, for the purpose of preventing noise disturbances or unreasonably loud noise. Noise exceeding certain levels or durations and during specific times of day can be detrimental to the health, safety, and welfare of the citizenry, and may infringe upon an individual's right to peaceful and quiet enjoyment of their activities of daily living. It is the policy of the city to prohibit noise disturbances or unreasonably loud noise from all sound sources, subject to its police power, in order to secure and promote the public health, comfort, convenience, safety, welfare, and prosperity of the citizens of Wilmington. Nothing in this article is intended to deter individuals from lawfully exercising the individual right of freedom of speech and commerce, or any other freedom guaranteed under the Constitutions of the United States of America or of the State of North Carolina, and nothing in this article is intended to unreasonably limit or restrain commercial or industrial enterprise.

(Ord. No. O-2019-43, § 2, 8-20-19)

Sec. 6-27. Scope.

This article shall apply to all sound, vibration, and other noise originating within the corporate limits of the City of Wilmington. Nothing in this article shall be construed to limit or prevent the City of Wilmington or any person from pursuing any other legal remedies for damages or the abatement of noise. The Wilmington Police Department shall have primary enforcement responsibility for noise and sound level control pursuant to this article.

(Ord. No. O-2019-43, § 2, 8-20-19)

Sec. 6-28. General prohibition.

Except as allowed in this article, no person shall willfully engage in any activity on any premises or public area in the city, which activity produces or constitutes a noise disturbance on adjoining or neighboring properties or public areas. A violation of section 6-28 shall constitute a misdemeanor.

(Ord. No. O-2019-43, § 2, 8-20-19; Ord. No. O-2021-84, § 1(Exh. 2, § 3), 11-16-21)

Sec. 6-29. Definitions.

The words and phrases defined in this section shall have the meaning indicated when used in this article unless otherwise specifically provided, or unless otherwise clearly required by the context:

---

[1]Editor's note(s)—Ord. No. O-2019-43, § 2, adopted Aug. 20, 2019, repealed the former Art. II, §§ 6-26—6-32, and enacted a new Art. II as set out herein. The former Art. II pertained to similar subject matter and derived from Ord. of 2-21-89, § 3; Ord. of 10-19-93, §§ 2.a.1—5, 2.b—e, 2.f, 2.g.1—4, 2.h; Ord. of 10-17-00, § 2; Ord. of 1-24-95, § 1.

"A" weighting scale. The sound pressure level in decibels as measured on a sound level meter using the A-frequency-weighted network and slow meter response setting. Sound levels are represented herein by the designation dB(A).

Absentee owner. An owner of any premises subject to this article who is not also an occupant of the premises.

Adjoining property. Property which shares a contiguous boundary with another property.

Amplified sound. Any sound or noise, including the human voice, that is increased in volume or intensity by means of electrical power.

ANSI. The American National Standards Institute or its successor bodies.

Commercial establishment. An establishment used for commercial purposes with common business areas.

Commercial/industrial area. Any area within the city that is zoned AI, IND, LI, CB, CS, RB, O&I, UMX, MX, or RFMU, or any area presently devoted to a commercial use that is a nonconforming situation as defined by the zoning ordinance.

Construction. On-site erection, fabrication, installation, repair, alteration, demolition, or removal of any right-of-way surfaces, structure, facility, or addition thereto, including all related activities including, but not restricted to, clearing of land, earth moving, blasting, and landscaping.

Decibel (dB). Unit for describing the amplitude of sound, equal to twenty (20) times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure (twenty [20] micronewtons per square meter).

Downtown. Any area within the city that is zoned CBD.

Emergency. Any occurrence or set of circumstances involving actual or imminent physical or psychological trauma or property damage which demands immediate action in order to maintain or restore public safety and prevent or alleviate such trauma or property damage.

Impulsive sound. Sound of short duration, usually less than one (1) second, with an abrupt onset and rapid decay. Examples of sources of impulsive sound include explosions, drop forge impacts and the discharge of firearms.

Motorized vehicles. Generally-any motor vehicle as defined in G.S. 20-4.01 and G.S. 105-164.3, including but not limited to:

(1) Excursion passenger vehicles as defined in G.S. 20-4.01(27)a.

(2) Common carriers of passengers as defined in G.S. 20-4.01(27)c.

(3) Motorcycles and mopeds as defined in G.S. 20-4.01(27)d. and d.1.

(4) Truck tractors as defined in G.S. 20-4.01(48).

(5) Farm tractors as defined G.S. 20-4.01(11).

(6) Mopeds as defined in G.S. 105-164.3.

Necessary activity. Any activity analyzed and determined by the city to be an activity that cannot be avoided for the purpose of construction, public safety, constitutionality, or any other activity otherwise prohibited which the city considers acceptable to be permitted for a limited period of time.

Necessary business equipment. A piece(s) of equipment physically affixed, joined, or connected to the outside of a building, and without which a business located inside the building would not be able to operate. Examples include but are not limited to heating and air conditioning units, electrical generators, water pumps, ventilation systems, and air/water chillers.

Neighboring property. Property which does not share a contiguous boundary with another property, but which is close enough in proximity to be affected by sound produced on the other property.

Noise disturbance. Any sound or combination of sounds which, because of its volume or quality or time of day, tends to annoy, disturb, frighten, or otherwise cause an adverse psychological or physiological effect upon reasonable persons of normal sensitivity, or unreasonably prevents such persons from being able to enjoy their activities of daily living.

Person. Any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, agency, political subdivision of this state, any other state or political subdivision or agency thereof, or any legal successor, representative, agent or agency of the foregoing.

Plainly audible. Any sound or component of sound for which any of the content of that sound is unambiguous, verifiable, and discernible above ambient levels by a person using his or her unaided hearing faculties, including but not limited to comprehensible musical rhythms, understandable speech, or rhythmic bass.

Residential areas. Any area within the city that is zoned R-15, R-10, R-7, R-5, R-3, MHP, MF-L, MF-M, MF-H, HD-R, HD, RO, or HDMU.

Responsible person. An owner, tenant, occupant, employee, agent, or any other person who is or who appears to be responsible for the premises, dwelling, or commercial establishment creating, allowing, or causing to be created a noise disturbance in violation of this article.

Sound. Any disturbance of the air or other medium that is detectable by the unaided human ear or which produces vibrations detectable by persons of normal sensitivity.

Sound level. The weighted sound pressure level obtained by the use of a sound level meter and frequency weighting network as specified in ANSI specifications for sound level meters.

Sound level meter. Device used to measure sound pressure levels with a standardized frequency weighting and indicated exponential time weighting for measurements of sound level, or without time weighting for measurement of time-average sound pressure level or sound exposure level.

Sound pressure level. In decibels, twenty (20) times the logarithm to the base ten (10) of the ratio of the magnitude of a particular sound pressure to the standard reference pressure. The standard reference pressure is 0.0002 microbars.

Sound source. Any person, animal, device, operation, process, activity, or phenomenon which emits or causes sound.

(Ord. No. O-2019-43, § 2, 8-20-19)

Sec. 6-30. Specific prohibitions.

The following acts are specifically declared to be unreasonably loud, annoying, frightening, or disturbing sounds which constitute a noise disturbance and the emission of which shall therefore constitute a violation of this article:

(a) The sounding of any horn or signal device on any automobile, motorcycle, bus or other vehicle for an unnecessary or unreasonable period of time, or for the purpose of harassing another person.

(b) The use of any siren upon any vehicle other than police, fire, ambulance, or other emergency vehicles.

(c) Operation of any motor vehicle without a proper muffler system, as defined in G.S. § 20-128(a).

(d) Construction activity in residential or downtown areas between the hours of Midnight and 7:00 a.m., or at any time on the following holidays: New Year's Day, Thanksgiving Day, or Christmas Day, except by permit for necessary activity.

(e) The intentional projection of sound from any drum, music, loudspeaker, or other instrument or device onto adjoining or neighboring properties for the purpose of attracting attention by creation of noise to any business, location, performance, show, event, sale, or display.

(f) Keeping any animal or bird which frequently or for long periods of time makes noises that would tend to disturb or annoy a reasonable person of normal sensitivity in the vicinity.

(g) The collection of garbage, recyclables, or yard waste between the hours of midnight and 7:00 a.m. in residential areas.

(h) The operation of lawn mowers and other domestic power tools outside between the hours of midnight and 7:00 a.m.

(i) A violation of section 6-30 shall constitute a misdemeanor.

(Ord. No. O-2019-43, § 2, 8-20-19; Ord. No. O-2021-84, § 1(Exh. 2, § 3), 11-16-21)

Sec. 6-31. Exceptions.

To the extent that such uses are for a legitimate purpose, the following are excepted from the application of this article:

(a) Sound or noise emanating from regularly scheduled outdoor athletic events held at Legion Stadium, on the campus of the University of North Carolina at Wilmington, at any city park, or at any school athletic facility within the city limits, and occurring between the hours of 7:00 a.m. and midnight;

(b) Sound or noise emanating from concerts and other events held at Greenfield Lake Amphitheater, Legion Stadium, and the Northern Waterfront Park between the hours of 7:00 a.m. and midnight;

(c) Construction activity performed by or for an agency of government, provided that all equipment is operated in accordance with manufacturer's specifications and is equipped with all noise-reducing equipment in proper condition;

(d) Sound or noise of safety signals, warning devices, and emergency pressure relief valves;

(e) Sound from church bells and the bells of the New Hanover County Courthouse, provided that bells may not sound for more than five (5) minutes in any hour and may only mark the hour between the hours of midnight and 7:00 a.m.;

(f) Sound or noise emanating from street fairs, festivals, or other public celebrations produced, sponsored, or approved by the City of Wilmington;

(g) Sound or noise emanating from film and video production activities for which film permits have been issued by the city, provided that all equipment is operated in accordance with manufacturer's specifications and is equipped with all standard noise-reducing equipment in proper condition;

(h) Sound or noise from lawful fireworks;

(i) Lawnmowers, agricultural equipment, and domestic power tools operated between the hours of 7:00 a.m. and midnight, provided that all equipment is operated in accordance with manufacturer's specifications and is equipped with all standard noise-reducing equipment in proper condition;

(j) Necessary business equipment, provided that such equipment is operated in accordance with manufacturer's specifications, is in good working order, and is equipped with appropriate noise-reducing equipment and any reasonable screening;

(k) Music during parades or military ceremonies;

(l) The collection of garbage, recyclables, or yard waste between the hours of 7:00 a.m. and midnight;

(m) Emergency vehicles in the course of performing their official duties; and

(n) Any other sound authorized by city-issued permit or city contract, to the extent allowed by such permit or contract.

(Ord. No. O-2019-43, § 2, 8-20-19)

Sec. 6-32. Noise violation based on sound level meters.

(a) Enforcement of this article does not require the use of a sound level meter to determine compliance. However, when a sound level meter is used to determine sound levels pursuant to this article, the standards, instrumentation, personnel, measurement procedures, and reporting procedures shall be as specified in this section, and all terminology not defined in this section shall be in conformance with the ANSI.

(b) Sound level measurement shall be made with a sound level meter using the A-weighting scale, set on slow response.

(c) Sound level meters shall be serviced, calibrated, and operated as recommended by the manufacturer and in accordance with regulations prescribed by the police department. Persons using the sound level meter shall be trained in sound level measurement and the operation of sound level measuring equipment.

(d) Sound level measurements shall be made from within the boundary line of an adjoining or complaining property. Whether the sound level violates the prescribed limits in section 6-33 below will be determined by whether the readings taken within the adjoining or complaining property are in excess of the levels allowed for the zoning area of the property that is the source of the sound.

(e) Except as specified in subsection (g) below, the sound level measurement shall be averaged over a period of at least one (1) minute for purposes of determining the sound level. Sound levels may not exceed the prescribed level by more than three (3) decibels at any time during the measurement period.

(f) During sound level measurement, the microphone shall not be positioned so as to create any unnatural enhancement of the measured sound. A windscreen shall be used when appropriate.

(g) Traffic noise and noise from other sources not connected with the sound being measured shall not be considered in taking sound level measurements.

(h) In the case of noise that is impulsive or not continuous, the sound level measurement shall be taken over a period of time of at least one (1) minute. Any such sound or noise that exceeds the prescribed level more than two (2) times in a minute shall be deemed to exceed the prescribed sound levels.

(i) If an officer does not have possession of a department-owned and ANSI-approved sound level meter at the time of responding to a noise complaint, sound level measurements for the purpose of determining violations of this article may not be taken using any other device, including but not limited to applications on cellular devices or any hand-held personal sound level meters obtained from any other source. The officer shall instead proceed under the other sections of this article in order to determine whether a noise disturbance is occurring.

(j) A violation of section 6-32 shall constitute a misdemeanor.

(Ord. No. O-2019-43, § 2, 8-20-19; Ord. No. O-2021-84, § 1(Exh. 2, § 3), 11-16-21)

Sec. 6-33. Sound level limits by zoning area.

Maximum Sound Level Readings
(Downtown)

7:00 a.m. to Midnight	75 dB(A)	Midnight to 7:00 a.m.	65 dB(A)
(Residential)			
7:00 a.m. to Midnight	65 dB(A)	Midnight to 7:00 a.m.	55 dB(A)
(Commercial/Industrial)			
7:00 a.m. to Midnight	75 dB(A)	Midnight to 7:00 a.m.	70 dB(A)

(Ord. No. O-2019-43, § 2, 8-20-19)

Sec. 6-34. Noise permits.

(a) A noise permit shall be obtained in advance for any activity where the sound level to be produced exceeds or should be reasonably expected to exceed the sound level limits or time limits set out in this article on any other property.

(b) Any application for a permit under this section shall be submitted to the Wilmington Police Department at least five (5) city business days in advance of the planned use, except for a necessary activity. The application shall designate a responsible person who shall be in control of the sound producing or sound amplification equipment or the contact person for the event, and who will ensure that the equipment or event complies with the terms of the permit.

(c) The chief of police or his/her designee shall have the ability to alter the times allowable under the permit and the acceptable sound levels allowed under the permit. Except in the case of necessary activities, the chief of police shall not extend the allowable time limit for a prohibited or excepted activity by more than one (1) hour, or increase the allowable sound level for any activity by more than ten (10) decibels over the sound level limits otherwise allowed in this article.

(d) In the city manager's discretion and after consultation with the chief of police or his/her designee, the city manager shall have the ability to alter the allowable time limit for a prohibited or excepted activity by more than one (1) hour, or increase the allowable sound level for any activity by more than ten (10) decibels over the sound level limits otherwise allowed in this article.

(e) No more than thirty (30) days of events, consecutive or otherwise, may be applied for using any single permit.

(f) If multiple events are applied for using the same permit, in no case shall the time allowed between the first event on the permit and the last event on the permit be more than one (1) calendar year.

(g) The following criteria shall be considered in the determination of whether to grant or deny an application for a noise permit:

(1) The use and activities permitted by the zoning regulations in such areas;

(2) The intensity of sound levels regularly produced by activities and devices in such areas;

(3) The time at which the sound amplification will occur;

(4) The duration of the requested amplification;

(5) The proximity of the requested activity to commercial buildings and residential dwellings, and the density of the surrounding commercial and residential areas;

(6) The history of verified complaints generated by previous activities similar in nature and context;

(7) The history of noise complaints against the applicant from adjoining or neighboring properties;

(8) Whether the sounds produced by such devices and activities are plainly audible, recurrent, intermittent, impulsive, or constant;

(9) Failure to complete the application properly; and

(10) The necessity of the requested amplification.

(f) If an applicant is denied a permit under this section, the reasons for denial shall be set forth in writing and furnished to the applicant. If an applicant believes the denial is improper for any reason, the applicant shall promptly submit a copy of the denied permit application, together with a short statement of the reasons he believes he is entitled to a permit, to the city manager or his/her designee. The city manager shall have the discretion to review the appeal and grant the permit, upon his determination that the applicant has made a substantial showing of entitlement, with any conditions or amendments to the permit that the city manager deems to be in the best interest of the public and the city.

(g) A violation of section 6-34 shall be a civil citation or a misdemeanor, may also be the basis for revocation of any permit, in the discretion of the police officer responding to the noise complaint, upon consultation with his supervising officer.

(Ord. No. O-2019-43, § 2, 8-20-19; Ord. No. O-2021-84, § 1(Exh. 2, § 3), 11-16-21)

Sec. 6-35. Noise violations not based on sound level meters.

(a) Any police officer responding to a noise complaint may, in the officer's discretion, issue a civil citation or enforce any other penalties under this article if the officer determines that a noise disturbance, as defined in section 6-29, does exist.

(b) An officer does not have to use a sound level meter or actually witness the sound or noise personally in order to take enforcement action under this section. Citations may be issued based upon statements and evidence obtained from complaining witnesses when the officer determines that such evidence is reliable, appropriate, and sufficient.

(c) It shall be a violation of this article for any person to communicate a noise complaint to any city staff or official, using the 911 system or otherwise, for the purpose of harassing the subject of the complaint, and knowing or having reason to know that no noise disturbance actually exists or existed.

(d) Factors to consider in determining whether a noise disturbance exists include, but are not limited to, the following:

(1) The volume of the noise;

(2) The intensity of the noise;

(3) Whether the nature of the noise is usual or unusual;

(4) Whether the origin of the noise is natural or unnatural;

(5) The volume and intensity of the background noise, if any;

(6) The proximity of the noise to residential sleeping facilities;

(7) The nature and zoning of the area from which the noise emanates;

(8) The density of the inhabitation of the area from which the noise emanates;

(9) The time of the day or night the noise occurs;

(10) The duration of the noise;

(11) Statements of any complaining witnesses, including any pictures or audio/video documentation produced by complaining witnesses; and

(12) Whether the noise is recurrent, impulsive, intermittent, or constant.

(e) A violation of section 6-35 shall constitute a misdemeanor.

(Ord. No. O-2019-43, § 2, 8-20-19; Ord. No. O-2021-84, § 1(Exh. 2, § 3), 11-16-21)

Sec. 6-36. Owner/occupant responsibility.

(a) Penalties for violations of this article may be assessed against persons responsible for either the premises or the sound source.

(b) All persons responsible for either the premises or the sound source who are actively or constructively present at the time of the violation shall be listed on the same citation, and shall be jointly and severally responsible for any such violation.

(c) An absentee owner shall be responsible for any actions by tenants, guests, or other licensees that constitute third or subsequent violations of this article.

(d) No absentee owner shall be liable unless such owner has already been notified of first or previous violations of the article, and further provided that such first or previous violations shall have occurred within the previous twelve-month period. Notice of any first or previous violations pursuant to this paragraph shall be effected by registered or certified mail.

(e) No absentee owner may be subjected to criminal liability under this section.

(f) The person responsible for any premises shall be responsible and liable for any violations of this article by tenants, guests, or licensees on the premises if the person responsible is actively or constructively present at the time of the violation.

(g) Any person responsible for causing a violation of this article on or at any commercial establishment shall be liable for any civil or criminal remedy which may be imposed by this article.

(h) Any person in charge of, and physically present, at any commercial establishment shall also be liable for any civil or criminal remedy which may be imposed by this article.

(i) It is no defense to either civil or criminal liability of the person in charge of a commercial establishment that a violation of this article was caused by a tenant, guest, invitee, permittee, or licensee.

(j) A violation of section 6-36 shall constitute a misdemeanor.

(Ord. No. O-2019-43, § 2, 8-20-19; Ord. No. O-2021-84, § 1(Exh. 2, § 3), 11-16-21)

Sec. 6-37. Noise violation appeal process.

(a) Any person issued a civil penalty under the provisions of this article may appeal by filing an appeal in writing to the chief of police within ten (10) calendar days after the civil penalty is issued. The written appeal shall state all reasons that the civil penalty was wrongly applied and shall include all supporting documentation that the appellant contends supports the appeal.

(b) If a person files a written appeal within the time provided in this section, the penalty being appealed shall be stayed pending the decision of the chief of police.

(c) The chief of police, or his/her designee at the rank of bureau commander or higher, shall issue a written determination, within ten (10) working days of receipt of the written appeal, stating whether the disputed civil penalty will be approved without change or modified or reversed.

(d) All decisions shall be served on the petitioner.

(e) The determination of the chief of police, or his/her designee at the rank of bureau commander or higher, is final, subject to appeal only in the Superior Court of New Hanover County by proceedings in the nature of certiorari, such appeal to be filed within thirty (30) days of the date the adverse decision was mailed.

(Ord. No. O-2019-43, § 2, 8-20-19)

Appendix Y

EJScreen Community Report

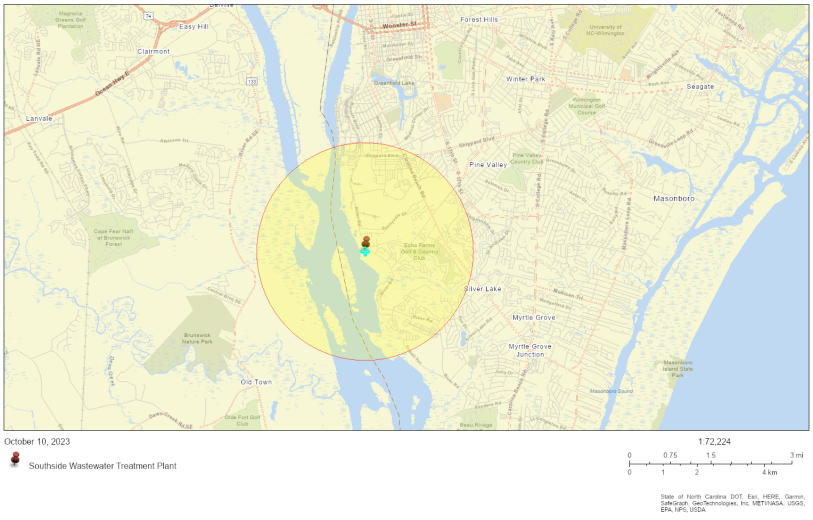
EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Wilmington, NC

2 miles Ring Centered at 34.166008,-77.946855
Population: 10,139
Area in square miles: 12.56

A3 Landscape



October 10, 2023
1:72,224
0 0.75 1.5 3 mi
0 1 2 4 km

State of North Carolina DOT, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

COMMUNITY INFORMATION

- Low income: 41 percent
- People of color: 33 percent
- Less than high school education: 12 percent
- Limited English households: 3 percent
- Unemployment: 2 percent
- Persons with disabilities: 14 percent
- Male: 51 percent
- Female: 49 percent
- 76 years — Average life expectancy
- $35,782 — Per capita income
- Number of households: 4,678
- Owner occupied: 50 percent

BREAKDOWN BY RACE

- White: 67%
- Black: 14%
- American Indian: 0%
- Asian: 0%
- Hawaiian/Pacific Islander: 0%
- Other race: 0%
- Two or more races: 3%
- Hispanic: 16%

BREAKDOWN BY AGE

From Ages 1 to 4	5%
From Ages 1 to 18	22%
From Ages 18 and up	78%
From Ages 65 and up	19%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	48%
Speak Other Indo-European Languages	12%
Speak Asian-Pacific Island Languages	40%
Speak Other Languages	0%

LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	87%
Spanish	9%
Other Indo-European	1%
Other Asian and Pacific Island	1%
Arabic	2%
Total Non-English	13%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

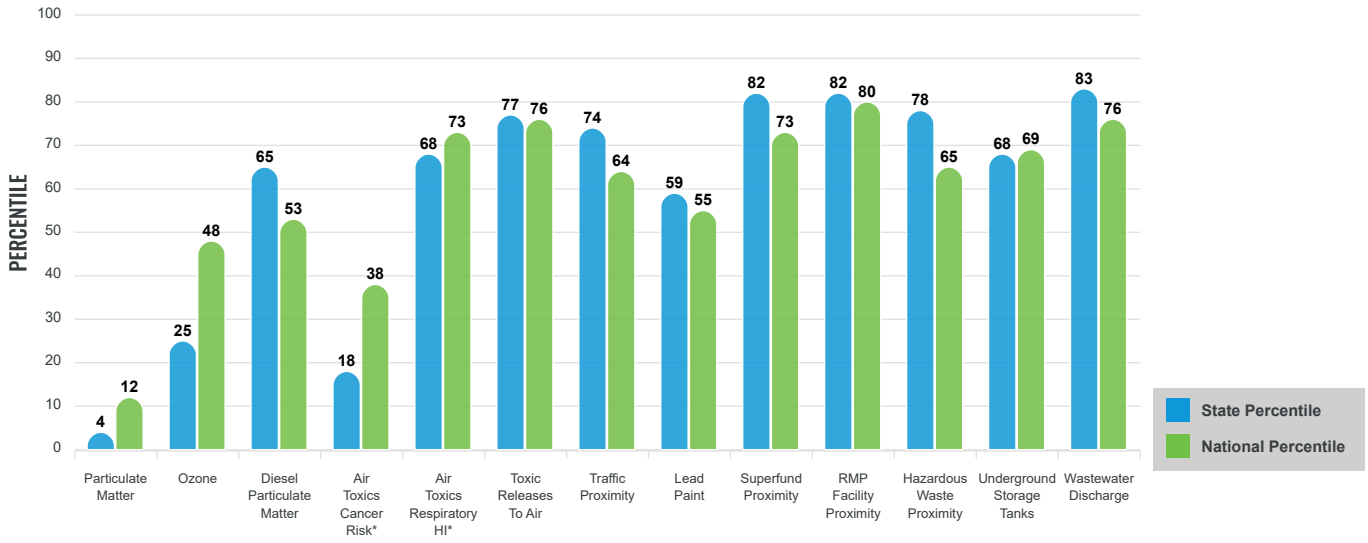
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

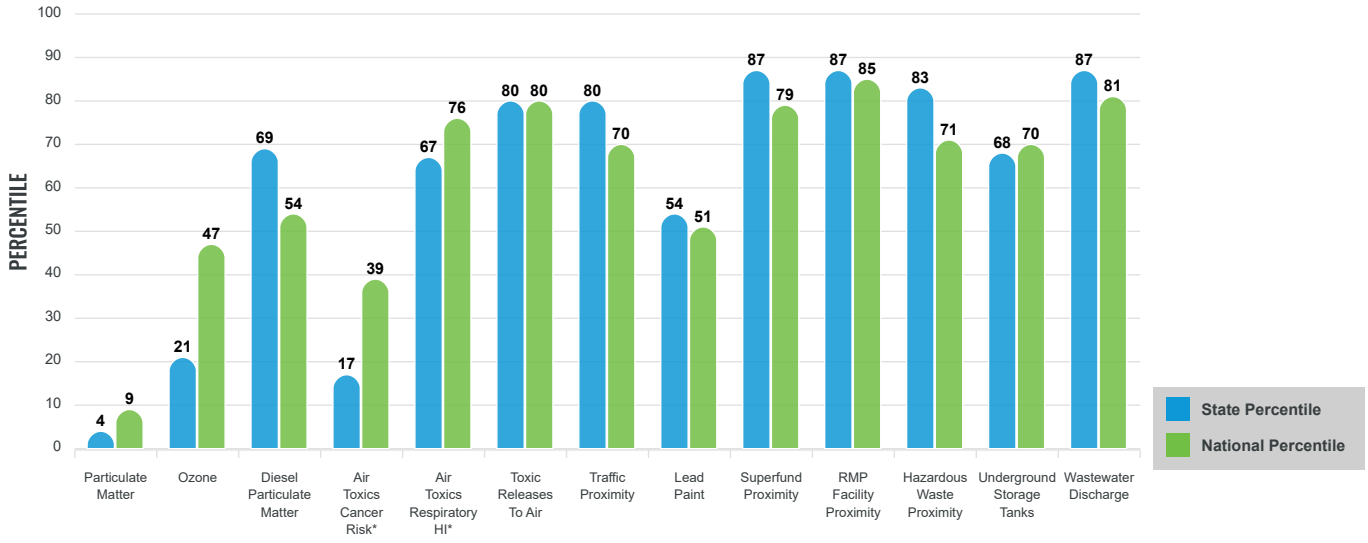
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 2 miles Ring Centered at 34.166008,-77.946855

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	5.42	7.8	2	8.08	5
Ozone (ppb)	58.9	61.7	14	61.6	30
Diesel Particulate Matter (µg/m^3)	0.152	0.168	49	0.261	32
Air Toxics Cancer Risk* (lifetime risk per million)	20	27	1	25	5
Air Toxics Respiratory HI*	0.33	0.34	54	0.31	31
Toxic Releases to Air	1,800	3,100	67	4,600	70
Traffic Proximity (daily traffic count/distance to road)	97	79	74	210	56
Lead Paint (% Pre-1960 Housing)	0.13	0.17	54	0.3	39
Superfund Proximity (site count/km distance)	0.097	0.081	80	0.13	66
RMP Facility Proximity (facility count/km distance)	1.2	0.26	96	0.43	91
Hazardous Waste Proximity (facility count/km distance)	0.65	0.52	79	1.9	54
Underground Storage Tanks (count/km^2)	3.4	3.9	69	3.9	69
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.038	0.25	87	22	77
SOCIOECONOMIC INDICATORS					
Demographic Index	37%	36%	59	35%	61
Supplemental Demographic Index	17%	15%	64	14%	68
People of Color	33%	37%	52	39%	52
Low Income	41%	34%	64	31%	71
Unemployment Rate	2%	6%	39	6%	37
Limited English Speaking Households	3%	2%	79	5%	69
Less Than High School Education	12%	12%	58	12%	63
Under Age 5	5%	5%	58	6%	56
Over Age 64	19%	18%	61	17%	64
Low Life Expectancy	22%	21%	65	20%	74

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund	0
Hazardous Waste, Treatment, Storage, and Disposal Facilities	1
Water Dischargers	24
Air Pollution	19
Brownfields	1
Toxic Release Inventory	8

Other community features within defined area:

Schools	2
Hospitals	0
Places of Worship	2

Other environmental data:

Air Non-attainment	No
Impaired Waters	Yes

Selected location contains American Indian Reservation Lands*	No
Selected location contains a "Justice40 (CEJST)" disadvantaged community	Yes
Selected location contains an EPA IRA disadvantaged community	Yes

Report for 2 miles Ring Centered at 34.166008,-77.946855

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	22%	21%	65	20%	74
Heart Disease	6.6	6.5	49	6.1	62
Asthma	9.7	9.4	58	10	43
Cancer	6.4	6.2	51	6.1	54
Persons with Disabilities	13.3%	14%	46	13.4%	55

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	19%	10%	90	12%	84
Wildfire Risk	74%	9%	93	14%	88

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	12%	16%	46	14%	53
Lack of Health Insurance	16%	11%	82	9%	87
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

Report for 2 miles Ring Centered at 34.166008,-77.946855

Appendix Z

CFPUA FY 2024 Rates and Fees Schedule

CAPE FEAR PUBLIC UTILITY AUTHORITY
RATES AND FEES SCHEDULE FY 23-24

			Rates and Fees Effective 07/01/2022	Rates and Fees Effective 07/01/2023	Ordinance Reference
1	**WATER RATES & FEES**				
	Water rates include both a fixed meter charge based on meter size and consumption charge based on metered consumption, billed monthly.				
A.	**Fixed Meter Charge by Meter Size***		**Monthly**	**Monthly**	
		5/8"	$ 16.21	$ 16.21	Sec. 1-97 (1) f
		1" (Single-Family Residential with fire sprinkler system)	$ 16.21	$ 16.21	Sec. 1-97 (1) f
		1"	$ 40.53	$ 40.53	Sec. 1-97 (1) f
		1 1/2"	$ 81.05	$ 81.05	Sec. 1-97 (1) f
		2"	$ 129.68	$ 129.68	Sec. 1-97 (1) f
		3"	$ 243.15	$ 243.15	Sec. 1-97 (1) f
		4"	$ 405.25	$ 405.25	Sec. 1-97 (1) f
		6"	$ 810.50	$ 810.50	Sec. 1-97 (1) f
		8"	$ 1,296.80	$ 1,296.80	Sec. 1-97 (1) f
		10"	$ 2,026.25	$ 1,945.20	Sec. 1-97 (1) f
		12"	$ 2,431.50	$ 2,431.50	Sec. 1-97 (1) f
	* Fixed Meter Charge is not applied to Irrigation Meters if a separate Water Meter exists.				
B.	**Consumption Charge (per 1,000 gallons)****		$ 4.74	$ 4.74	Sec. 1-97 (1) c
	** Single-Family Residential is serviced by one domestic meter				
			Monthly	**Monthly**	
C.	**Availability Charge for unconnected 5/8" water service; Availability Charge for larger meters based on meter size**		$ 16.21	$ 16.21	Sec. 1-97 (1) a
D.	**Bulk Water Rates**				
	Bulk Water Resale Rate (per 1,000 gallons)		$ 4.11	$ 1.70	Sec. 1-97 (1) b
	Bulk Water Resale Rate (per monthly MGD reserved)			$ 28,604.00	Sec. 1-97 (1) b
E.	**Water Service Connection Fee***				
	Service Line Connection Fee by Service Size				
		1" Service	$ 1,850.00	$ 2,035.00	Sec. 1-97 (2) a; Sec. 1-5 c
	Inspection Fee for Developer-Installed Connection		$ 55.00	$ 55.00	Sec. 1-97 (2) b; Sec. 1-6 a
	Inspection Fee for Developer-Installed Connection (After hours - Minimum of 2 hours)		$75/hour	$75/hour	Sec. 1-97 (2) b; Sec. 1-6 a
F.	**Meter Set Fee by Meter Size (includes labor and materials)**				
		5/8"	$ 250.00	$ 300.00	Sec. 1-97 (2) c; Sec. 1-5 c
		5/8" Split Service	$ 575.00	$ 640.00	Sec. 1-97 (2) c; Sec. 1-5 c
		1"	$ 350.00	$ 390.00	Sec. 1-97 (2) c; Sec. 1-5 c
		1 1/2"	$ 1,600.00	$ 1,660.00	Sec. 1-97 (2) c; Sec. 1-5 c
		2"	$ 1,800.00	$ 1,875.00	Sec. 1-97 (2) c; Sec. 1-5 c
G.	**System Development Charges**				
	Water by Meter Size				Sec. 4-27 (a)
		5/8"	$ 2,230.00	$ 2,270.00	Sec. 1-97 (2) d
		1" (Single-Family Residential with fire sprinkler system)	$ 2,230.00	$ 2,270.00	Sec. 1-97 (2) d
		1"	$ 5,575.00	$ 5,675.00	Sec. 1-97 (2) d
		1 1/2"	$ 11,150.00	$ 11,350.00	Sec. 1-97 (2) d
		2"	$ 17,840.00	$ 18,160.00	Sec. 1-97 (2) d
		3"	$ 33,450.00	$ 34,050.00	Sec. 1-97 (2) d
		4"	$ 55,750.00	$ 56,750.00	Sec. 1-97 (2) d
		6"	$ 111,500.00	$ 113,500.00	Sec. 1-97 (2) d
		8"	$ 178,400.00	$ 181,600.00	Sec. 1-97 (2) d
		10"	$ 278,750.00	$ 272,400.00	Sec. 1-97 (2) d
H.	**Special Use of Water**				
	Water Rates include both a fixed meter charge as referenced in Section A based on meter size plus consumption charge based on metered consumption as referenced in Section B, billed monthly. In addition, an initital set up fee will be assessed when the hydrant meter is issued based on meter size as follows:				
	Fixed Meter Charge by Size		**Initial Fee**	**Initial Fee**	
		5/8"	$ 31.00	$ 31.00	Sec. 1-97 (3) g
		3/4"	$ 35.00	$ 35.00	Sec. 1-97 (3) g
		1"	$ 45.00	$ 45.00	Sec. 1-97 (3) g
		1 1/2"	$ 56.00	$ 56.00	Sec. 1-97 (3) g
		2"	$ 96.00	$ 96.00	Sec. 1-97 (3) g
		3"	$ 165.00	$ 165.00	Sec. 1-97 (3) g
		4"	$ 254.00	$ 254.00	Sec. 1-97 (3) g
		6"	$ 437.00	$ 437.00	Sec. 1-97 (3) g
		Lost or stolen special use sign	$ 50.00	$ 50.00	Sec. 1-97 (3) g
I.	**Water Quality Fees**				
	Inspection Fees Backflow Assembly				
		Initial inspection	No Charge	No Charge	Sec. 1-97 (2) b
		Initial inspection	$ 55.00	$ 55.00	Sec. 1-97 (2) b
J.	**Fire Line Service**				
	Fixed Fire Line Charge by Size		**Monthly**	**Monthly**	
		2"	$ 10.00	$ 10.00	Sec. 1-97 (1) e
		3"	$ 15.00	$ 15.00	Sec. 1-97 (1) e
		4"	$ 20.00	$ 20.00	Sec. 1-97 (1) e
		6"	$ 40.00	$ 40.00	Sec. 1-97 (1) e
		8"	$ 70.00	$ 70.00	Sec. 1-97 (1) e
		10"	$ 110.00	$ 110.00	Sec. 1-97 (1) e
		12"	$ 160.00	$ 160.00	Sec. 1-97 (1) e

CAPE FEAR PUBLIC UTILITY AUTHORITY
RATES AND FEES SCHEDULE FY 23-24

			Rates and Fees Effective 07/01/2022	Rates and Fees Effective 07/01/2023	Ordinance Reference
2	**SEWER RATES & FEES**				
	Sewer rates include both a fixed meter charge based on meter size and consumption charge based on metered consumption, billed monthly.				
A.	**Fixed Meter Charge by Meter Size**		**Monthly**	**Monthly**	
		5/8"	$ 14.55	$ 16.86	Sec. 1-97 (1) f; Sec. 1-75
		1" (Single-Family Residential with fire sprinkler system)	$ 14.55	$ 16.86	Sec. 1-97 (1) f; Sec. 1-75
		1"	$ 36.38	$ 42.15	Sec. 1-97 (1) f; Sec. 1-75
		1 1/2"	$ 72.75	$ 84.30	Sec. 1-97 (1) f; Sec. 1-75
		2"	$ 116.40	$ 134.88	Sec. 1-97 (1) f; Sec. 1-75
		3"	$ 218.25	$ 252.90	Sec. 1-97 (1) f; Sec. 1-75
		4"	$ 363.75	$ 421.50	Sec. 1-97 (1) f; Sec. 1-75
		6"	$ 727.50	$ 843.00	Sec. 1-97 (1) f; Sec. 1-75
		8"	$ 1,164.00	$ 1,348.80	Sec. 1-97 (1) f; Sec. 1-75
		10"	$ 1,818.75	$ 2,023.20	Sec. 1-97 (1) f; Sec. 1-75
		12"	$ 2,182.50	$ 2,529.00	Sec. 1-97 (1) f; Sec. 1-75
B.	**Consumption Charge (per 1,000 gallons) See Notes 1 & 2**		$ 4.63	$ 4.84	Sec. 1-97 (1) c; Sec. 1-75
	Note 1	Single-Family Residential metered consumption capped at 15,000 gallons per monthly billing			Sec. 1-97 (1) c; Sec. 1-75
	Note 2	No cap for non-residential metered consumption			Sec. 1-97 (1) g; Sec. 1-75
C.	**Flat Sewer Charge**				
		Residential (Note 1)	$ 33.53	$ 36.70	Sec. 1-97 (1) c; Sec. 1-75
		Non-residential (Note 2)			
		5/8"	$ 36.77	$ 40.58	Sec. 1-97 (1) c; Sec. 1-75
		1"	$ 92.87	$ 98.29	Sec. 1-97 (1) c; Sec. 1-75
		1 1/2"	$ 188.96	$ 210.14	Sec. 1-97 (1) c; Sec. 1-75
		2"	$ 387.72	$ 424.80	Sec. 1-97 (1) c; Sec. 1-75
		3"	$ 627.54	$ 703.50	Sec. 1-97 (1) c; Sec. 1-75
		4"	$ 1,199.00	$ 1,241.88	Sec. 1-97 (1) c; Sec. 1-75
		6"	$ 1,942.41	$ 2,134.80	Sec. 1-97 (1) c; Sec. 1-75
		8"	$ 4,058.21	$ 4,915.88	Sec. 1-97 (1) c; Sec. 1-75
		10"	$ 5,189.39	$ 5,461.54	Sec. 1-97 (1) c; Sec. 1-75
	Note 1	The residential flat sewer rate consists of the fixed meter charge for a 5/8" meter plus assumed consumption based on the average consumption for residential customers having domestic metered water service during the most recent calendar year			
	Note 2	Each tier of the non-residential flat sewer rate consists of the fixed meter charge for the assumed meter size plus assumed consumption based on the average metered consumption for non-residential customers having that meter size during the most recent calendar year			
			Monthly	**Monthly**	
D.	**Availability Charge for unconnected 5/8" sewer service; Availability Charge for larger meters based on meter size**		$ 14.55	$ 16.86	Sec. 1-97 (1) a
E.	**Bulk Wastewater Collection and Treatement Rates**				Sec. 1-97 (1) b
	Bulk Wastewater Collection and Treatement Rate (per 1,000 gallons)		$3.34	$2.69	Sec. 1-97 (1) b
	Bulk Wastewater Resale Rate (per monthly MGD reserved)			$45,272	Sec. 1-97 (1) b
F.	**Sewer Service Connection Fee**				
	Installation Fee by Service Size				
		4" Service	$ 2,200.00	$ 2,420.00	Sec. 1-97 (2) a; Sec. 1-5 c
	Inspection Fee for Developer-Installed Connection		$ 55.00	$ 55.00	Sec. 1-97 (2) b; Sec. 1-6 a
	Inspection Fee for Developer-Installed Connection (After hours - Minimum of 2 hours)		$75/hour	$75/hour	Sec. 1-97 (2) b; Sec. 1-6 a
G.	**System Development Charges**				
	Sewer by Meter Size				Sec. 4-47 (a)
		5/8"	$ 2,160.00	$ 3,290.00	Sec. 1-97 (2) d
		1" (Single-Family Residential with fire sprinkler system)	$ 2,160.00	$ 3,290.00	Sec. 1-97 (2) d
		1"	$ 5,400.00	$ 8,225.00	Sec. 1-97 (2) d
		1 1/2"	$ 10,800.00	$ 16,450.00	Sec. 1-97 (2) d
		2"	$ 17,280.00	$ 26,320.00	Sec. 1-97 (2) d
		3"	$ 32,400.00	$ 49,350.00	Sec. 1-97 (2) d
		4"	$ 54,000.00	$ 82,250.00	Sec. 1-97 (2) d
		6"	$ 108,000.00	$ 164,500.00	Sec. 1-97 (2) d
		8"	$ 172,800.00	$ 263,200.00	Sec. 1-97 (2) d
		10"	$ 270,000.00	$ 394,800.00	Sec. 1-97 (2) d
H.	**Grinder Pump Fees**				
	Residential grinder pump fee, monthly		$15.00	$15.00	
	Developer grinder pump fee per platted lot		$300.00	$300.00	
3	**Wastewater Pretreatment**				
A.	**Discharge Permit Applications and Annual Fees:**				
	Significant Industrial Users, Industrial Users flow > 15,000 gallons/day				
		Initial and Annual Permit	$ 750.00	$ 750.00	Sec. 5-58: Sec. 5-91 (b)
		Modification of Permit (each occurrence)	$ 200.00	$ 200.00	Sec. 5-58: Sec. 5-91 (b)
		Restoration of Revoked Permit (each occurrence)	$ 1,500.00	$ 1,500.00	Sec. 5-58: Sec. 5-91 (b)
		Monitoring Fee	Individually determined	Individually determined	Sec. 5-58
		Enforcement Cost Recovery	Individually determined	Individually determined	Sec. 1-97 (3) j; Sec. 5-58
B.	**Other Wastewater Permits**				
		Flow Less than 1,000 gallons/day (initial and annual)	$ 100.00	$ 100.00	Sec. 5-58: Sec. 5-91 (a)
		Flow Between 1,000 and 7,500 gallons/day (initial and annual)	$ 200.00	$ 200.00	Sec. 5-58: Sec. 5-91 (a)
		Flow Between 7,501 and 15,000 gallons/day (initial and annual)	$ 300.00	$ 300.00	Sec. 5-58: Sec. 5-91 (a)
		Monitoring Fee	Individually determined	Individually determined	Sec. 5-58
		Food Service Establishment Permit and Annual Inspection Fee (per location)	$ 100.00	$ 100.00	Sec. 5-58: Sec. 5-91 (a)
		Grease Interceptor Pumping Variance (each occurrence)	$ 220.00	$ 220.00	Sec. 5-58
		Enforcement Cost Recovery	Individually determined	Individually determined	Sec. 1-97 (3) j; Sec. 5-58
		Restoration Fee of Revoked Other Wastewater Permit (each occurrence)	2x permit fee	2x permit fee	Sec. 1-97 (1) d; Sec. 5-58
		Residuals permit application fee (initial and renewals)	$ 100.00	$ 100.00	Sec. 5-58

CAPE FEAR PUBLIC UTILITY AUTHORITY
RATES AND FEES SCHEDULE FY 23-24

			Rates and Fees Effective 07/01/2022	Rates and Fees Effective 07/01/2023	Ordinance Reference
C.	**Pretreatment Wastewater Treatment Surcharges**		**Monthly**	**Monthly**	
		Surcharge for BOD (per 100 lbs; when BOD>200mg/L and COD < 3x BOD)****	$ 36.00	$ 36.00	Sec. 1-97 (1) d; Sec. 5-57
		Surcharge for COD (per 100 lbs; when COD>600mg/L and >/=3xBOD)****	$ 36.00	$ 36.00	Sec. 1-97 (1) d; Sec. 5-57
		Surcharge for TSS (per 100 lbs; when TSS >200mg/l)	$ 21.00	$ 21.00	Sec. 1-97 (1) d; Sec. 5-57
		**** Surcharge is assessed for either BOD or COD, but not both.			
D.	**Charges for Septage Haulers**		**Monthly**	**Monthly**	
		In-Service Area Rate (per gallon)	$ 0.1378	$ 0.1378	Sec. 1-97 (1) b; Sec. 5-33
		Out-of-Service Area Rate (per gallon)	$ 0.1723	$ 0.1723	Sec. 1-97 (1) b; Sec. 5-33
		Utility Deposit	$ 500.0000	$ 500.0000	Sec. 1-6
E.	**Charges for Miscellaneous Hauled Wastewater Fees (subject to applicable surcharges)**				
		Short-Term Permit	**Monthly**	**Monthly**	
		Per gallon Within Service Area	$ 0.032	$ 0.032	Sec. 1-97 (1) b; Sec. 5-33
		Per gallon Out-of-Service Area	$ 0.064	$ 0.064	Sec. 1-97 (1) b; Sec. 5-33
		Long-Term Permit			
		One Time System Development Charge In accordance with Fee Schedule and specified in permit.			Sec. 1-97 (2)d; Sec. 5-58
			Monthly	**Monthly**	
		Long-Term Permit Monthly Consumption Charge (per 1,000 gallons)	$ 4.63	$ 4.63	Sec. 1-97 (1) c; Sec. 5-58
		Long-Term Permit Monthly Fixed Meter Charge by Meter Size/Flow:			
		5/8" (Flow between 0-28,800 gpd)	$ 14.55	$ 14.55	Sec. 1-97 (1) f; Sec. 5-58
		1" (Flow between 28,801-72,000 gpd)	$ 36.38	$ 36.38	Sec. 1-97 (1) f; Sec. 5-58
		1 1/2" (Flow between 72,001-144,000 gpd)	$ 72.75	$ 72.75	Sec. 1-97 (1) f; Sec. 5-58
		2" (Flow between 144,001-230,400 gpd)	$ 116.40	$ 116.40	Sec. 1-97 (1) f; Sec. 5-58
		3" (Flow between 230,401-460,800 gpd)	$ 218.25	$ 218.25	Sec. 1-97 (1) f; Sec. 5-58
		4" (Flow between 460,801-720,000 gpd)	$ 363.75	$ 363.75	Sec. 1-97 (1) f; Sec. 5-58
		6" (Flow between 720,001-1,440,000 gpd)	$ 727.50	$ 727.50	Sec. 1-97 (1) f; Sec. 5-58
		8" (Flow between 1,440,001-2,304,000 gpd)	$ 1,164.00	$ 1,164.00	Sec. 1-97 (1) f; Sec. 5-58
		10" (Flow between 2,304,001-3,312,000 gpd)	$ 1,818.75	$ 1,818.75	Sec. 1-97 (1) f; Sec. 5-58
		12" (Flow > 3,312,001 gpd)	$ 2,182.50	$ 2,182.50	Sec. 1-97 (1) f; Sec. 5-58
F.	**Processing Charge for Haulers of Non-Hazardous Wastewater Treatment Plant (WWTP) Residuals as delivered to a designated CFPUA WWTP (Per Pound Total Solids Dry Weight Basis as Delivered/Received)**		**Monthly**	**Monthly**	
		Unstabilized/Less Than Class B Residuals In-Service Area Rate	$ 0.8020	$ 0.8020	Sec. 1-97 (1) b; Sec. 5-33
		Stabilized/Equal to or Better Than Class B Residuals In-Service Area Rate	$ 0.6015	$ 0.6015	Sec. 1-97 (1) b; Sec. 5-33
		Unstabilized/Less Than Class B Residuals Out-of-Service Area Rate	$ 1.0025	$ 1.0025	Sec. 1-97 (1) b; Sec. 5-33
		Stabilized/Equal to or Better Than Class B Residuals Out-of-Service Area Rate	$ 0.7519	$ 0.7519	Sec. 1-97 (1) b; Sec. 5-33
4	**Penalties**				
A.	**Tampering Violations**				
		Unauthorized non-metered use of water (greater of 15,000 gallons consumption or the highest billed consumption in the past 24 months)	$60.30	$60.30	Sec. 1-97 (3) m; Sec 1-166 (c)
		Unauthorized non-metered use of sewer (capped at 15,000 gallons consumption)	$69.45	$69.45	Sec. 1-97 (3) m; Sec 1-166 (c)
		Cut Lock Fee	$75.00	$75.00	Sec. 1-97 (3) f; Sec. 1-166 (c)
		Unauthorized turn on or turn off water supplied by Authority	$55.00	$55.00	Sec. 1-9 (g); Sec. 1-9(h)
		Meter Obstruction Fee	$55.00	$55.00	Sec. 1-97 (3) q
		System Tampering Civil Action Violation, in accordance with N.C.G.S. 14-151(e)	Triple the amount of losses and damages sustained by the Authority or $5,000, whichever is greater	Triple the amount of losses and damages sustained by the Authority or $5,000, whichever is greater	Sec. 1-97 (3) r
		Violation of Cross Connection Control Ordinance	Up to $1,000/day	Up to $1,000/day	Sec. 2-10 (j)
B.	**Backflow Preventer Violations**				
		Commercial failure to submit required backflow preventer test report	$200.00	$200.00	Sec. 2-10 (d)
		Residential failure to submit required backflow preventer test report	$100.00	$100.00	Sec. 2-10 (d)
		Submission of falsified backflow preventer test report	$200.00	$200.00	Sec. 2-10 (d)
		First violation of backflow installation requirements	$250.00	$250.00	Sec. 2-10 (b)
		Subsequent violation of backflow installation requirements	$1,000.00	$1,000.00	Sec. 2-10 (b)
C.	**Pretreatment Violations**				
		Violation of Wastewater Discharge Permit	Up to $25,000	Up to $25,000	Sec. 5-189
		Violation of Sewer Use Ordinance	Up to $25,000	Up to $25,000	Sec. 5-189
D.	**Water Emergency Management Ordinance**				
		Violation of Water Emergency Management Regulations	Up to $500/day	Up to $500/day	Sec. 3-13 (d)
5	**Miscellaneous and Other**				
A.	**Service/repair costs**				
		Contracted services at actual cost plus 10% administrative fee	Individually determined	Individually determined	Sec. 1-9 (e)
		CFPUA staff and equipment at FEMA reimbursable cost	Individually determined	Individually determined	Sec. 1-9 (e)
B.	**Other Fees**				
		After Hours Fee	Individually determined	Individually determined	Sec. 1-97 (3) a
		Emergency Reconnect Fee	$ 110.00	$ 120.00	Sec. 1-97 (3) c
		Late Day Reconnect Fee	$ 55.00	$ 60.00	Sec. 1-97 (3) b
		Late Fee	5% of current charges	5% of current charges	Sec. 1-97 (3) h
		Loan Processing Fee/Deferral Fee	Actual Cost to File	Actual Cost to File	Sec. 1-97 (3) k
		Meter Test	$ 55.00	$ 60.00	Sec. 1-97 (3) l; Sec. 1-36; Sec. 1-161
		Large Meter Test (requested by Customer) (Meters 3" and larger)	$ 150.00	$ 150.00	Sec. 1-36; Sec. 1-161
		New Service Charge	$ 55.00	$ 55.00	Sec. 1-97 (3) d; Sec. 1-6 (a)
		Premise Visit Fee	$ 55.00	$ 60.00	Sec. 1-97 (3) p; Sec. 1-15
		Delinquency Fee	$ 55.00	$ 55.00	Sec. 1-97 (3)m; Sec. 1-166 (a)
		Reread Fee (requested by Customer)			
		Correct Read	$ 55.00	$ 60.00	Sec. 1-97 (3) o
		Incorrect Read (CFPUA error)	No Cost	No Cost	Sec. 1-97 (3) o
		Reconnection Fee (after disconnect)	$ 55.00	$ 60.00	Sec. 1-97 (3) n
		Utility Deposit Single-Family Residential (may be adjusted based on services provided and prior payment history)			Sec. 1-6

CAPE FEAR PUBLIC UTILITY AUTHORITY
RATES AND FEES SCHEDULE FY 23-24

			Rates and Fees Effective 07/01/2022	Rates and Fees Effective 07/01/2023	Ordinance Reference
		Utility Deposit Commercial			Sec. 1-6
		Hydrant Meter Deposit for festivals (up to 1 1/2" meter size)	$ 500.00	$ 500.00	Sec. 1-97 (3) g
		Hydrant Meter Deposit for festivals (2" and higher meter size)	Actual Cost	Actual Cost	Sec. 1-97 (3) g
		Hydrant Meter Installation & Removal for festivals (per meter)	$ 55.00	$ 55.00	Sec. 1-97 (3) g
		Plan Review Fees:			
		Minor Subdivisions - no required NCDEQ water or sewer permits	$ 120.00	$ 120.00	Sec. 1-97 (3) l; Sec. 4-3 (a)
		Commercial Plans (multi-family residential/commercial) - no required NCDEQ water and sewer permits	$ 120.00	$ 120.00	Sec. 1-97 (3) l; Sec. 4-3 (a)
		Main Extensions/Utility relocation/ROW widening less than 500 Linear Feet	$ 240.00	$ 240.00	Sec. 1-97 (3) l; Sec. 4-3 (a)
		Main Extensions/Utility relocation/ROW widening 500-999 Linear Feet	$ 300.00	$ 300.00	A
		Main Extensions/Utility relocation/ROW widening 1,000-4,999 linear feet	$ 600.00	$ 600.00	Sec. 1-97 (3) l; Sec. 4-3 (a)
		Main Extensions/Utility relocation/ROW widening 5,000-9,999 linear feet	$ 850.00	$ 850.00	Sec. 1-97 (3) l; Sec. 4-3 (a)
		Main Extensions/Utility relocation/ROW widening 10,000 linear feet and greater	$ 1,400.00	$ 1,400.00	Sec. 1-97 (3) l; Sec. 4-3 (a)
		Pump Station Review (plus the main extensions fee above)	$ 350.00	$ 350.00	Sec. 1-97 (3) l; Sec. 4-3 (a)
		Re-review Fee	$ 50.00	$ 50.00	Sec. 1-97 (3) l; Sec. 4-3 (a)
		Water/Sewer Line Acceptance Testing Reinspection	$55/hour	$55/hour	Sec. 4-3 (c)
		Water/Sewer Line Acceptance Testing Reinspection - After Hours Fee	$75/hour	$75/hour	Sec. 4-3 (c)
		Inspection Fee for Developer-Installed Main Lines (After hours - Minimum of 2 hours)	$75/hour	$75/hour	Sec. 1-97 (2) b; Sec. 1-6 (a)
		Demolition Inspection Fee	$ 55.00	$ 55.00	Sec. 1-97 (3) s; Sec. 1-6 (a)
		Violation of Extension Policy	$100, $200, $500	$100, $200, $500	Sec. 4-103
		Copy and Printing Fees, including Public Records Request	Actual cost	Actual cost	
		Tank Mounted Equipment Structural Analysis Review Fee	$ 2,025.00	$ 2,200.00	Sec. 1-97 (3) t
		Water Tower Lease	Individually determined; $2,500 minimum	Individually determined; $2,500 minimum	Set by contract
		Additional Antenna Fee - per antenna exceeding nine antennas	$ 300.00	$ 300.00	
		Ground Space Fee - Additional ground space above 400 square feet	$5.92/square foot	$5.92/square foot	
C.	**Miscellaneous Administrative Fees**				
		Returned Check Fee (Per event; Closed Account, NSF, Stop Payment of Customer/Vendor issued Check)	$ 25.00	$ 25.00	Sec. 1-97 (3) j
		Convenience Fee per transaction; maximum payment amount up to $300 per transaction.	$ 3.00	$ 3.00	
		Dishonored Bank Draft Fee (Per event; Closed Account, NSF, Stop Payment of Customer/Vendor Draft)	$ 25.00	$ 25.00	Sec. 1-97 (3) j
		Check Stop Payment Fee (Stop Payment of CFPUA issued Check requested by Customer/Vendor)	$ 5.00	$ 5.00	Sec. 1-97 (3) j
D.	**Development Capacity Fees**				
		Chair Road Associates - Regional Lift Station (PS #157) Only	$1.61 per gpd	$1.72 per gpd	Per Contract
		CFPUA Cost Recovery - Northwest Forcemain Improvements Only	$3.87 per gpd	$3.87 per gpd	Sec. 4-4 (c)
		CFPUA Cost Recovery - Pump Station 36 Improvements	$2.31 per gpd	$2.31 per gpd	Per Contract
		CFPUA Cost Recovery - Northern Water Main	$2.13 per gpd	$2.13 per gpd	Per Contract
		CFPUA Cost Recovery - Forest Creek Outfall	$12.87 per gpd	$12.87 per gpd	Per Contract
		CFPUA Cost Recovery - Chair Road Water Main	$1.12 per gpd	$1.12 per gpd	Per Contract

Appendix AA

Response to NCDEQ Comments (04/23/2024)

Request for Additional Information

A. General Comments (no response needed)

1. Provide a response to all comments on a comment-for-comment basis. You can include this as an appendix in the revised ER.
2. Highlight all changes with differently colored text in the body of the revised ER.
3. Please submit the revised Engineering Report incorporating all changes via the new Online Supporting Documentation Submittal Form located at https://edocs.deq.nc.gov/Forms/DW-Document-Upload-Form. The link to the online submittal form and a list of frequently asked questions can also be accessed from the Division's "I Have Funding" page, https://www.deq.nc.gov/about/divisions/water-infrastructure/i-have-funding.
4. Please note that the ER approval letter will be issued after receiving FONSI letter.
5. ER/EID should be prepared according to DWI guidance to meet the funding requirements. DWI ER/EID Guidance and all relevant template tables and spreadsheets located at https://www.deq.nc.gov/about/divisions/water-infrastructure/i-have-funding/engineering-reportenvironmental-information-document

B. Technical Comments

6. Section 1.0 Executive Summary:
    a. Please include a project vicinity and project location figure per DWI Guidance.
        i. See Figure 1 for a project vicinity map and Figure 2 for a project location map.
    b. Please briefly describe each of the alternatives including no-action alternative. Discuss why each was rejected in favor of the preferred alternative.
        i. Please see the revised executive summary for brief descriptions of each alternative, including the no-action alternative. A discussion of why each was rejected, in favor of the preferred alternative, was also added.
    c. Please provide project funding information to include the total cost, sources of funding, and the amount of funding for each source. Also discuss how it will impact user fees.
        i. Please see the revised executive summary for funding information including the total cost, sources of funding, and the amount of funding for each source. A discussion of how the proposed project will impact user fees was also included.
7. Section 2.0 Current Situation: Please revise this section to include subsections and tables according to the DWI Guidance for WWTP Expansion (Section 2.2) as this information is not provided.
    a. Please see revised Section 2.0 which includes the subsections and tables according to the DWI Guidance for WWTP Expansion.
8. Section 3.0 Future Situation:
    a. Please revise subsections and tables according to the DWI Guidance for WWTP Expansion (Section 3.2) as all required information is not provided.
        i. Please see revised Section 3.0.
    b. Please provide a mass balance analysis of pollutant loads. This should include wastewater flows and characteristics (BOD, TSS, ammonia nitrogen, TN, TP, etc.) of the plant influent. Please place this discussion and relevant tables under a new subsection.

i. Please see the discussion related to influent design flows and loads added to Section 3.0.

9. Section 4.0 Need and Purpose: Please include this section separately and according to the DWI Guidance.
    a. Please see revised Section 4.0 which includes distinct need and purpose statements.
10. Section 5.0 Alternative Analysis:
    a. Please revise this section to include a table for each alternative according to the DWI Guidance under Section 5.1 Alternative Description.
        i. Please see revised Section 5.0.
    b. Preferred alternative description should match Section 6.0 (Proposed Project) and Section 1.0 (Executive Summary).
        i. Preferred alternative description has been revised to match Section 6.0 (Proposed Project) and Section 1.0 (Executive Summary).
    c. Consider other alternatives mentioned in DWI Guidance Section 5.1.4.2 and different treatment technologies e.g. Biodenipho™ and AquaNereda Aerobic Granular Sludge (AGS).
        i. Please see revised Section 5.0.
    d. For each feasible alternative, we need present worth analysis which includes determination of capital cost, replacement cost, and operations and maintenance cost. You can find template present worth analysis tables in the link provided in comments 5.
        i. Please see revised Section 5.0.
11. Section 6.0 Proposed Project Description:
    a. Please revise this section separately and according to the DWI Guidance to include number of acres of land to be disturbed, environmental impacts, project cost (capital cost and total present worth), capacities of the new/improved equipment, existing treatment process, and level of treatment.
        i. Please see revised Section 6.0.
    b. Please provide preliminary peaking factor that will be applied to 16 MGD for peak flow design. Our calculation shows a peaking factor of 2.5 appears to be satisfactory.
        i. Please see revised Section 6.0.
    c. Please provide preliminary calculation and design criteria for each unit/component listed including headworks, primary clarifiers, biological treatment process, RAS pump station, secondary treatment process, secondary clarifiers, tertiary filters, UV, biosolids digesters, sludge thickening and dewatering, biosolid storage, liquid sludge storage, drain pump station, septage receiving, operation, maintenance, and lab building, outfall piping, reuse pump station, and generators.
        i. Please see revised Section 6.0.
    d. Please provide preliminary calculation for effluent characteristics and its summary as a table.
        i. Please see Section 6.2.
12. Section 8.0 Financial Analysis
    a. Please update all relevant tables and submittal checklist with an additional $35,000,000 at 1.76% interest SRF funding in Fall 2023. This additional loan was approved by SWIA although LOIF has not been issued yet due to negotiation of BABA language. This will bring total SRF funding to $70,000,000.
        i. Please see revised Section 8.0.
    b. Table 8.2:

i. Bond interest rate was mentioned 4.5% in description which does not match with 1.5% in this table. Please reconcile and update all subsequent tables.
    1. Please see revised Table 8.2.
ii. Please include the 2% closing fee for $70,0000,000 SRF loan.
    1. Please see revised Table 8.2.

13. Section 9.0 Public Participation: since the project requires FONSI, public meeting requirement mentioned in section 9.2.2 High Level of Public Involvement must be completed.
    a. Please see revised Section 9.0. The steps outlined in this revised section will be followed after Division staff have completed their reviews and resolved all technical and environmental issues.

C. Environmental Comments

14. General Comments:
    a. Please update and reference sections of the ER/EID with any outside correspondence that was received where applicable and attach these documents to the revised ER/EID.
        i. Additional appendices have been added to the revised ER/EID.
    b. For each applicable section where no secondary and cumulative impacts were identified, please explain why in the description line.
        i. Please see revised Section 7.0.
    c. For each section where secondary and cumulative impacts were identified, please provide the accompanying laws and ordinances in the mitigative measures description that could be associated and alter the checkbox selection where appropriate.
        i. Please see revised Section 7.0.
15. Section 1.0 Executive Summary:
    a. Revise this section to add a brief summary of the secondary and cumulative impacts that are expected to take place to the various environmental features and provide any mitigation processes that will be implemented. This summary does not have to go into detail for each resource category but should provide an overview considering the expected secondary and cumulative impacts in terms of time and space.
        i. Please see revised Section 1.0.
    b. Please focus on the additional growth in New Hanover County in relation to what secondary cumulative impacts can be expected due to this project.
        i. Please see revised Section 1.0.
16. Table 7.1. Topography and Floodplains: Please expand on the temporary construction impacts that will occur and provide any mitigative response to these impacts such as regrading site to original contour as a means of mitigative measures.
    a. Please see revised Table 7.1.
17. Table 7.2. Soils: Provide quantitative information of estimated area of soil to be impacted if known.
    a. Please see revised Table 7.2.
18. Table 7.7 Water Resources:
    a. For this table, please provide a description of the environmental points awarded in the project application. Line Items 2.O. and 2.P. respectively. (2.O. points -- Project directly benefits subwatersheds that are impaired as noted on the most recent version of the Integrated Report) (2.P. points – Project directly benefits specific classified waters).
        i. Please see revised Table 7.7.

b. Explain the beneficial operational impacts to water resources within the project site and within the project area.
    i. Please see revised Table 7.7.

19. Table 7.10. Shellfish, Fish, and Their Habitats:
    a. Describe if there are any closed beds, highly productive areas, or spawning areas present within the project area.
        i. Please see revised Table 7.10.
    b. Please provide discussion of past trends related to fish, shellfish, and their habitats regarding secondary and cumulative impacts within the project area and then characterize potential future impacts.
        i. Please see revised Table 7.10.
20. Table 7.11. Wildlife and Natural Vegetation:
    a. Please provide discussion of past trends related to wildlife and natural vegetation within the project area and then characterize potential future impacts.
        i. Please see revised Table 7.11.
    b. Describe the general species and habitat present in the project area besides the threatened and endangered species.
        i. Please see revised Table 7.11.
21. Table 7.14 Air Quality: For mitigative measures, please describe if construction vehicles will be equipped with emission control devices.
    a. Please see revised Table 7.14.
22. Table 7.18. Mitigative Measures:
    a. Revise the table as needed to reflect any changes made in response to the preceding comments, particularly related to SCI.
        i. Please see revised Table 7.18.
    b. For each section where secondary and cumulative impacts were identified, please provide the accompanying laws and ordinances in the mitigative measures that could be associated in the description column.
        i. Please see revised Table 7.18.

Appendix BB

Response to NCDEQ Comments (08/16/24)

Request for Additional Information

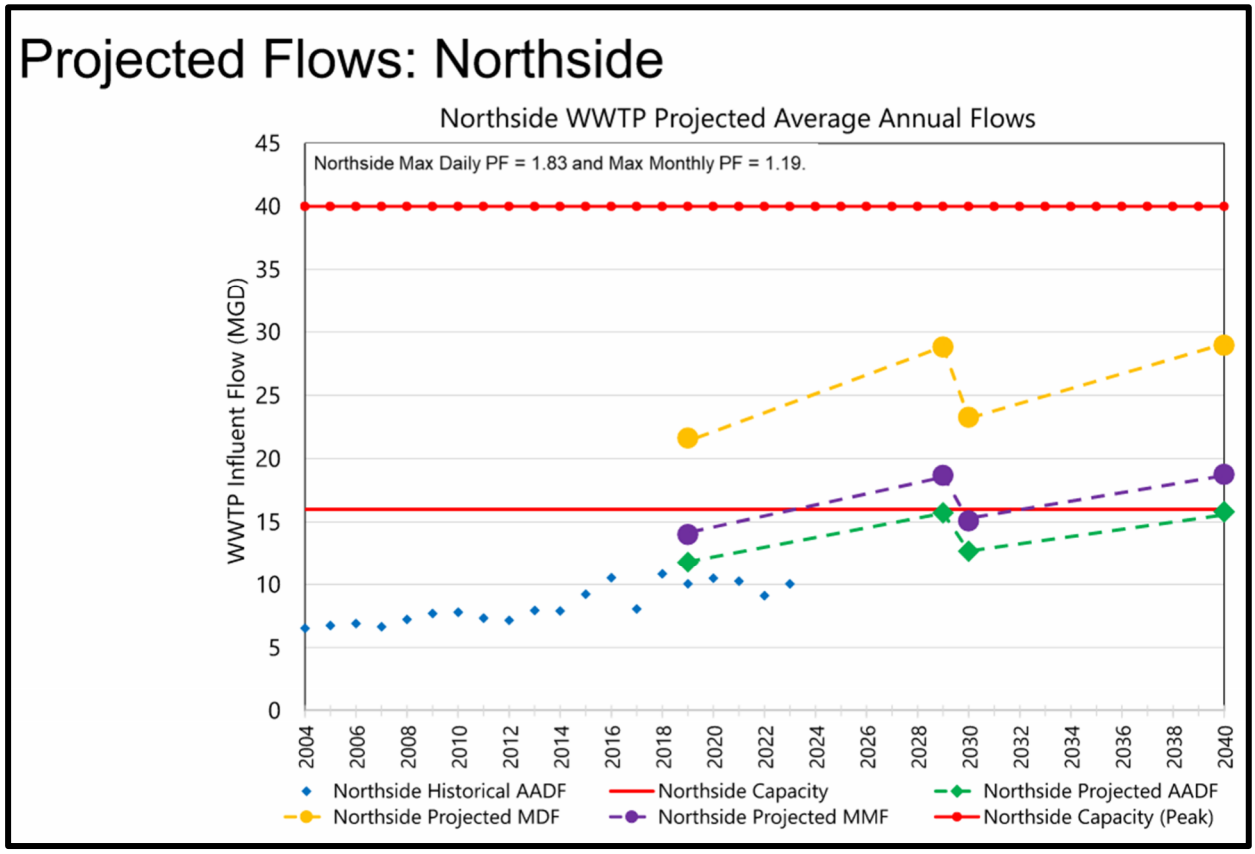
A. General Comments (no response needed)

1. Provide a response to all comments on a comment-for-comment basis. You can include this as an appendix in the revised ER.
2. Highlight all changes with differently colored text in the body of the revised ER.
    a. All changes have been highlighted in yellow in the revised ER.
3. Please submit the revised Engineering Report incorporating all changes via the new Online Supporting Documentation Submittal Form located at https://edocs.deq.nc.gov/Forms/DW-Document-Upload-Form. The link to the online submittal form and a list of frequently asked questions can also be accessed from the Division's "I Have Funding" page, https://www.deq.nc.gov/about/divisions/water-infrastructure/i-have-funding.
4. Please note that the ER approval letter will be issued after receiving FONSI letter.

B. Technical Comments

5. If the project is within the 500-year floodplain or affects the 500-year floodplain, project design must clearly list the measures taken to minimize the risk of flood damage to or within the floodplain. Please refer to the attached memo for further guidance.
    a. The proposed project will not affect the 500-year floodplain. No structures will be installed within the 500-year floodplain. Table 5.1.2 has been updated with this language. The proposed project will relocate the UV disinfection units out of the 100-year floodplain (and the 500-year floodplain), which will improve the overall resilience, reliability, and performance of the SSWWTP.
6. The approximate boundary of the Wilmington Municipality depicted in Figure 2 does not align with the proposed layout. Please revise the figure to ensure consistency.
    a. The approximate boundary of the Wilmington Municipality depicted in Figure 2 has been revised.
7. The minimum and maximum monthly average flows presented in Table 2.6 do not correspond with the data provided in Appendix F. Please review and revise the table as necessary.
    a. The minimum and maximum monthly average flows presented in Table 2.6 have been revised to match the data included in Appendix F.
8. According to Table 2.6, the current flow of 7.46 MGD represents 62% of the WWTP's 12 MGD capacity. Similarly, the projected 2044 flow of 10.87 MGD (as per Table 3.2) would utilize 68% of the expanded 16 MGD capacity. While industrial flow and summer user variation is understandable, and CFPUA is committed to reduce I&I, please provide detailed justification for flow projections and need for the expansion project.
    a. Table 3.2 (Future Flow Analysis) was updated to include an additional column titled "diverted flow". Currently, 2.7 MGD of raw wastewater is being diverted from the 12 MGD Southside WWTP to the 16 MGD Northside WWTP via pump station 35. According to CFPUA staff, this diversion was initiated to reduce the flow to the Southside WWTP (to delay expanding the facility) and was always meant to be temporary in nature. Based on flow projections for the Northside WWTP, as shown in the graph below, without directing the 2.7 MGD back to the Southside WWTP, the Northside WWTP will exceed its capacity before 2030. As such, CFPUA plans to redirect the 2.7 MGD back to the Southside WWTP by the year 2030 and upon completion of the proposed expansion.

With this revision, the wastewater flow to the Southside WWTP is expected to reach 13,575,536 gpd in 2044. This is approximately 84.85% of the expanded 16 MGD capacity, as shown in the table below. Section 1 & Table 2.2 have also been updated to reflect this revision.



	Year	County Population	Service Area Population	Residential Flow (gpd)	Commercial Flow (gpd)	Industrial Flow (gpd)	Diverted Flow (gpd)	Total Flow (gpd)	% of 16 MGD
1	2023	238,852	107,483	0	0	0	0	**7,206,100**	45.04%
2	2024	242,708	109,219	121,464	26,028	735,359	0	**8,088,951**	50.56%
3	2025	246,018	110,708	225,729	48,371	748,020	0	**8,228,219**	51.43%
4	2026	249,330	112,199	330,057	70,726	760,688	0	**8,367,572**	52.30%
5	2027	252,640	113,688	434,322	93,069	773,349	0	**8,506,840**	53.17%
6	2028	255,953	115,179	538,682	115,432	786,021	0	**8,646,235**	54.04%
7	2029	259,265	116,669	643,009	137,788	798,690	0	**8,785,587**	54.91%
8	2030	262,576	118,159	747,306	160,137	811,354	2,700,000	**11,624,897**	72.66%
9	2031	265,889	119,650	851,666	182,500	824,027	2,700,000	**11,764,292**	73.53%
10	2032	269,198	121,139	955,899	204,836	836,683	2,700,000	**11,903,518**	74.40%
11	2033	272,511	122,630	1,060,259	227,198	849,356	2,700,000	**12,042,912**	75.27%
12	2034	275,822	124,120	1,164,555	249,548	862,020	2,700,000	**12,182,223**	76.14%
13	2035	279,133	125,610	1,268,852	271,897	874,685	2,700,000	**12,321,533**	77.01%
14	2036	282,445	127,100	1,373,180	294,253	887,353	2,700,000	**12,460,885**	77.88%
15	2037	285,756	128,590	1,477,476	316,602	900,018	2,700,000	**12,600,196**	78.75%
16	2038	289,068	130,081	1,581,804	338,958	912,686	2,700,000	**12,739,548**	79.62%
17	2039	292,380	131,571	1,686,132	361,314	925,355	2,700,000	**12,878,901**	80.49%
18	2040	295,691	133,061	1,790,429	383,663	938,019	2,700,000	**13,018,211**	81.36%
19	2041	299,002	134,551	1,894,725	406,013	950,684	2,700,000	**13,157,521**	82.23%
20	2042	302,313	136,041	1,999,022	428,362	963,348	2,700,000	**13,296,832**	83.11%
21	2043	305,624	137,531	2,103,318	450,711	976,013	2,700,000	**13,436,142**	83.98%
22	2044	308,937	139,022	2,207,678	473,074	988,685	2,700,000	**13,575,536**	84.85%
23	2045	312,248	140,512	2,311,974	495,423	1,001,350	2,700,000	**13,714,847**	85.72%

9. Please provide additional justification for the inclusion of an equalization tank in the Bio-Denipho alternative but not in the preferred alternative.
    a. The equalization tank has been removed from the Bio-Denipho alternative. Table 5.1.6., Tables 5.2.2.1. – 5.2.2.6., Table 5.2.3., Figure 21, and Figure 22 have been updated to reflect this change.
    b. Preliminary engineering has determined that equalization is not needed for the preferred alternative; however, the need for equalization will be reassessed based on design constraints and the status of I&I reduction projects. The proposed site plan has available space for equalization should it be deemed a necessity in the detailed design phase.
10. The years listed in the headers of Tables 5.2.1.4 through 5.2.1.6 and Tables 5.2.2.4 through 5.2.2.6 must be consistent with the table titles. Please correct this discrepancy.
    a. The years listed in the headers of Tables 5.2.1.4 through 5.2.1.6. and Tables 5.2.2.4 through 5.2.2.6 have been revised to match the years listed in the table titles.
11. In Table 6.3, the three units of grit removal are designed to handle a peak flow of 30 MGD, while the peak flow for the 16 MGD permit limit is 40 MGD. Although grit removal is not an essential treatment unit, please clarify how the 10 MGD flow difference at peak times will be handled.
    a. Table 6.3 has been updated. Three grit removal units are proposed. Each unit will have a minimum of 8 trays and be rated for 16 MGD (peak flow 40 MGD). At full buildout, each grit removal unit will have 12 trays and be rated for 24 MGD (peak flow 60 MGD).
12. In Table 8.4, the Year 1 O&M costs do not match with Table 5.2.1.7. Please reconcile.
    a. The Year 1 O&M cost of Table 8.4 has been updated to match the Year 1 O&M listed in Table 5.2.1.7. Tables 8.4 – 8.6 have been updated to reflect the revised calculations.
13. The Year 1 O&M cost in Table 8.4 does not align with that in Table 5.2.1.7. Please reconcile the discrepancies between these tables.
    a. The Year 1 O&M cost of Table 8.4 has been updated to match the Year 1 O&M listed in Table 5.2.1.7. Tables 8.4 – 8.6 have been updated to reflect the revised calculations.